BS EN 61167:2016

BSI Standards Publication

# Metal halide lamps — Performance specification (IEC 61167:2015, modified)

bsi.

**National foreword**

This British Standard is the UK implementation of EN 61167:2016. It is derived from IEC 61167:2015. It supersedes BS EN 61167:2011 which is withdrawn.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags 〚C〉 〈C〛.

The UK participation in its preparation was entrusted by Technical Committee CPL/34, Lamps and Related Equipment, to Subcommittee CPL/34/1, Electric lamps.

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

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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**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2016.

**Amendments/corrigenda issued since publication**

| Date | Text affected |
|---|---|

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 61167

June 2016

ICS 29.140.30

English Version

# Metal halide lamps - Performance specification (IEC 61167:2015 , modified)

Lampes aux halogénures métalliques - Spécifications de performance
(IEC 61167:2015 , modifiée)

Halogen-Metalldampflampen - Anforderungen an die Arbeitsweise
(IEC 61167:2015 , modifiziert)




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

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**



Ref. No. EN 61167:2016 E

## European foreword

The text of document 34A/1809/FDIS, future edition 3 of IEC 61167, prepared by 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 61167:2016.

A draft amendment, which covers common modifications to IEC 61167 (34A/1809/FDIS), was prepared by CLC/TC 34A “Lamps” and approved by CENELEC.

The following dates are fixed:

| | | |
|---|---|---|
| • latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2016-12-10 |
| • latest date by which the national standards conflicting with the document have to be withdrawn | (dow) | 2019-06-10 |

This document supersedes EN 61167:2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] 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 61167:2015 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 61167:2015 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, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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

| Publication | Year | Title | EN/HD | Year |
|---|---|---|---|---|
| | | 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 | 1987 | 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 | - |
| IEC 60598-1 | - | Luminaires - General requirements and tests | EN 60598-1 | - |
| IEC 60923 | - | Auxiliaries for lamps - Ballasts for discharge lamps (excluding tubular fluorescent lamps) - Performance requirements | EN 60923 | - |
| IEC 60927 | - | Auxiliaries for lamps - Starting devices (other than glow starters) - Performance requirements | EN 60927 | - |
| IEC/TR 61341 | - | Method of measurement of centre beam intensity and beam angle(s) of reflector lamps | EN 61341 | - |
| IEC 62035 | - | Discharge lamps (excluding fluorescent lamps) - Safety specifications | EN 62035 | - |
| 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 | |
| IEC 62471 | - | Photobiological safety of lamp and lamp systems | EN 62471 | - |

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

# Annex ZZA
(informative)

## Relationship between this European Standard and the ecodesign requirements of Commission Regulation (EC) No 245/2009 aimed to be covered

This European Standard has been prepared under a Commission's standardization request M/495 to provide one voluntary means of conforming to the ecodesign requirements of Commission Regulation (EC) No 245/2009 of 18 March 2009 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council [2009 OJ L76].

Once this standard is cited in the Official Journal of the European Union under that Regulation, compliance with the normative clauses of this standard given in Table ZZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding ecodesign requirements of that Regulation and associated EFTA Regulations.

**Table ZZA.1 – Correspondence between this European Standard and Commission Regulation (EC) No 245/2009 of 18 March 2009 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council [2009 OJ L76] and Commission's standardization request M/495**

| Ecodesign requirements of Regulation No 245/2009 [2009 OJ L76] | Clause(s) / sub-clause(s) of this EN | Remarks / Notes |
|---|---|---|
| Annex III, Article 2 | Annex B or Annex E as appropriate | Lamp power |
| Annex III, Article 1.3 | Annex B or Annex E as appropriate | Luminous flux |
| Annex III, Article 1.2, Table 14 | Subclause 4.Z4 | Lamp survival factor |
| Annex III, Article 1.2, Table 14 | Subclause 4.Z3 | Lumen maintenance |
| Annex II, Article 3(b) | Subclause 4.8.4 | Chromaticity coordinates |
| Annex III, Article 1.3 (h) | Subclause 4.8.4 | Colour rendering index (CRI) |
| Annex III, Article 1.3 (g) | Subclause 4.8.4 | Correlated colour temperature (CCT) |
| Annex III, Article 2 | Annex B or Annex E as appropriate | Spectral power distribution |
| Annex I, Article 1(d), (h) | Annex B or Annex E as appropriate | specific effective radiant UV power |
| Annex I, Article 1 (i) | Subclause 4.4 | Caps |
| Annex III, Article 1.3 (f), Annex V, Article 2 | Subclause 4.Z5 | Mercury content |

**WARNING 1 —** Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

**WARNING 2 —** Other Union legislation may be applicable to the products falling within the scope of this standard.

# Annex ZZB
(informative)

## Relationship between this European Standard and the ecodesign requirements of Commission Regulation (EU) No 1194/2012 aimed to be covered

This European Standard has been prepared under a Commission's standardization request M/495 to provide one voluntary means of conforming to the ecodesign requirements of Commission Regulation (EU) No 1194/2012 of 12 December 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment [2012 OJ L342].

Once this standard is cited in the Official Journal of the European Union under that Regulation, compliance with the normative clauses of this standard given in Table ZZB.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding ecodesign requirements of that Regulation and associated EFTA Regulations.

**Table ZZB.1 – Correspondence between this European Standard and Commission Regulation (EU) No 1194/2012 of 12 December 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment [2012 OJ L342] and Commission's standardization request M/495**

| Ecodesign requirements of Regulation No 1194/2012 [2012 OJ L342] | Clause(s) / sub-clause(s) of this EN | Remarks / Notes |
|---|---|---|
| Article 2.4, 3.1, Annex I | Subclause 4.2 | Technical description of special purpose lamps for eco-design |
| Annex III, Article 1<br>Annex III, Article 3.1 | Annex B or Annex E as appropriate | Lamp power |
| Annex III, Article 3.1.1, 3.1.2 (a), 3.1.3 (c) | Subclause 4.Z1 | Useful luminous flux |
| Annex III, Article 3.1.2 (i), 3.1.3 (k) | Annex B or Annex E as appropriate | Beam angle |
| Annex III, Table 4, Article 3.1.3 | Subclause 4.Z4 | Lamp life |
| Annex III, Table 4, Table 7, Article 3.1.3 | Subclause 4.Z3 | Lumen maintenance |
| | Not covered in this standard | Number of switching cycles before failure |
| Annex III, Table 4 | Subclause 4.5, Annex A | Starting time |
| Annex III, Table 4 | Subclause 4.5, Annex A | Warm-up time to 60% $\phi$ |
| Annex I | Subclause 4.8.4 | Chromaticity coordinates |
| Annex III, article 3.1.3 (h) | Subclause 4.8.4 | Colour rendering index (CRI) |
| Annex III, article 3.1.1, 3.1.2 (c) | Subclause 4.8.4 | Correlated colour temperature (CCT) |
| | Not covered in this standard | Power factor<br>(only for lamps with integrated control gear) |
| Annex III, article 3.1.2 (h) | Subclause 4.3 (Data sheets Clause 6) | Lamp dimensions |
| Annex III, article 3.1.3 (m) | Annex B or Annex E as | Spectral power distribution |

| Ecodesign requirements of Regulation No 1194/2012 [2012 OJ L342] | Clause(s) / sub-clause(s) of this EN | Remarks / Notes |
|---|---|---|
| | appropriate | |
| Annex III, article 3.1.2 (n), (o) | Subclause 4.Z5 | Mercury content |
| | Not covered in this standard | Dimmability |
| | Not covered in this standard | Lamp type (MR11 GU4 etc.) |
| Annex III, article 3.1.3 (j) | Annex B or Annex E as appropriate | Peak intensity in candela |

**WARNING 1 —** Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

**WARNING 2 —** Other Union legislation may be applicable to the products falling within the scope of this standard.

# Annex ZZC
(informative)

## Relationship between this European Standard and the energy labelling requirements of Commission Delegated Regulation (EU) No 874/2012 aimed to be covered

This European standard has been prepared under a Commission's standardisation request M/495 to provide one voluntary means of conforming to the energy labelling requirements of Commission Delegated Regulation (EU) No 874/2012 of 12 July 2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires [2012 OJ L258].

Once this standard is cited in the Official Journal of the European Union under that Regulation, compliance with the normative clauses of this standard given in Table ZZC.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding energy labelling requirements of that Regulation and associated EFTA Regulations.

**Table ZZC.1 – Correspondence between this European Standard and Commission Delegated Regulation (EU) No 874/2012 of 12 July 2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires [2012 OJ L258] and Commission's standardisation request M/495**

| Energy labelling requirements of Regulation No 874/2012 [2012 OJ L258] | Clause(s) / sub-clause(s) of this EN | Remarks / Notes |
|---|---|---|
| Article 1 | Annex B or Annex E as appropriate | Applicable parameter according to Article 1: luminous flux |
| Annex VII | Annex B or Annex E as appropriate | Lamp power |
| Annex VII | Annex B or Annex E as appropriate | Luminous flux (non-directional only) |
| Annex VII | Subclause 4.Z1 | Useful luminous flux (directional only) |
| Annex VII | Annex B or Annex E as appropriate | Beam angle |

WARNING 1: Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2: Other Union legislation may be applicable to the products falling within the scope of this standard.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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# 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.
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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.

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

This third edition replaces the second edition published in 2011. This third edition constitutes a technical revision.

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

a) A set of new lamp data sheets (20 W, 35 W, 50 W, 100 W) is introduced.
b) Reference to ILCOS (International lamp coding system) is removed from the lamp data sheets and now located in a new annex.
c) Information on outer bulb temperature (and in some cases also on pin temperature and temperature adjacent to cap) is replaced with an explanation on differences in manufacturers' construction; this explanation is given in detail in a new annex.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|---|---|
| 34A/1809/FDIS | 34A/1830/RVD |

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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

NOTE In this standard, the following print types are used:

– Requirements proper: in roman type.

– *Test specifications: in italic type*.

– Explanatory matter: in smaller roman type.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication 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 have been reached for introduction of new lamp types and in aspects of operation which led to the third edition.

Major changes of the **second edition** are as follows. Since IEC 62035 *Discharge lamps (excluding fluorescent lamps) – Safety specifications* was published in 1999, the related lamp specific performance standards like 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 has already been carried out with other HID lamps. So, in some instances, the “pilot” text of IEC 60188 has been used. Moreover, the measurement part has been 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 were needed for long time, the new technique of low frequency square wave (LFSW) operation was implemented. This has 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 for experts from lamp and control gear side in order to accommodate the interface between control gear and lamp to these requirements.

IEC SC34A MT PRESCO took the opportunity to add further lamp types which were considered of having market relevance and needing normative support.

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 1039-1, 1041-1, 1080-1 and 1082-1.

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

The holder of this patent has assured the IEC that he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of these patents is registered with the 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) and IEC (http://www.iec.ch/tctools/patent_decl.htm) 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.

Major changes of the **third edition** are as follows. Compared to the 2nd edition, a set of new lamp data sheets (20 W, 35 W, 50 W, 100 W) is introduced. Reference to ILCOS (International lamp coding system) is removed from the lamp data sheets and now located in a new annex. Information on outer bulb temperature (and in some cases also on pin temperature and temperature adjacent to cap) is replaced with an explanation on differences in manufacturers' construction; this explanation is given in detail in a new annex.

# METAL HALIDE LAMPS – PERFORMANCE SPECIFICATION

## 1 Scope

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

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

The requirements of this standard relate only to type testing.

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

It may be expected that with the tolerances given in the standard, the product manufactured in accordance with the type test sample will comply with the standard 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 IEC 60410.

## 〈C〉 Z1 Overall statement

Where a Commission Regulation specifies limits for parameters these limits shall be used instead of the limits specified in this standard. 〈C〉

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-845:1987, *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*

IEC 60598-1, *Luminaires – General requirements and tests*

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 84, *The measurement of luminous flux*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions in IEC 60050-845 and the following apply.

**3.1**
**metal halide lamp**
high-intensity discharge lamp in which the major portion of the light is produced by the radiation of a mixture of metallic vapour, metal halides and the products issued from the dissociation of metal halides

Note 1 to entry: The definition covers clear and coated lamps.

[SOURCE: IEC 60050-845:1987, 845.07.25, modified]

**3.2**
**nominal value**
approximate quantity value used to designate or identify a lamp

[SOURCE: IEC 60081, 1.4.3]

**3.3**
**rated value**
quantity value for a characteristic of a lamp for specified operating conditions

The value and the conditions are specified in this standard, or assigned by the manufacturer or responsible vendor.

[SOURCE: IEC 60081, 1.4.4]

**3.4**
**lumen maintenance**
ratio of the luminous flux of a lamp at a given time in its life to the initial reading of its luminous flux, the lamp being operated under specific conditions

Note 1 to entry: The ratio is generally expressed as a percentage.

**3.5**
**initial readings**
starting characteristics of a lamp, measured before ageing, and the electrical and photometric characteristics, measured at the end of the 100 h ageing period

**3.6**
**reference ballast**
special ballast complying with the requirements of IEC 60923, designed for the purpose of providing comparison standards for use in testing ballasts, for the selection of reference lamps and for testing regular production lamps under standardised conditions

Note 1 to entry: It is essentially characterised by the fact that, at its rated frequency, it has a stable voltage/current ratio which is relatively uninfluenced by variations in current, temperature and electromagnetic surroundings, as outlined in the relevant ballast standard.

[SOURCE: IEC 60662:2011, 3.4, modified]

**3.7**
**calibration current**
value of the current on which the calibration and control of the reference ballast are based

**3.8**
**type test**
test or a series of tests made on a type test sample for the purpose of checking compliance of the design of a given product with the requirements of the relevant standard

[SOURCE: IEC 60081:1997, 1.4.10]

**3.9**
**specific effective radiant UV power**
effective power of the UV radiation of a lamp related to its luminous flux

Note 1 to entry: Specific effective radiant UV power is expressed in mW/klm

Note 2 to entry: The effective power of the UV radiation is obtained by weighting the spectral power distribution of the lamp with the UV hazard function $S_{UV}(\Lambda)$. Information about the relevant UV hazard function is given in IEC 62471. It only relates to possible hazards regarding UV exposure of human beings. It does not deal with the possible influence of optical radiation on materials, like mechanical damage or discoloration.

**3.10**
**type test sample**
sample consisting of one or more similar units submitted by the manufacturer or the responsible vendor for the purpose of a type test

**3.11**
**inrush current**
short term high lamp current, totally or partially rectified, by the asymmetrical electrode heating for some seconds during lamp ignition

**3.12**
**warm-up current**
increased lamp current after inrush phase which is due to the low initial lamp voltage

Note 1 to entry: It is in the limits of double rated lamp current down to a value corresponding to highest allowed lamp voltage.

**3.13**
**run-up time**
after switching on a 100 h aged lamp at rated supply voltage, maximum time allowed to reach 90 % of the declared luminous flux

**3.14**
**take-over**
time between lamp being able to conduct current until electrodes are at thermionic emission

Note 1 to entry: At the end of the take-over phase, the lamp power factor is above 0,9 and the lamp voltage stabilises and ramps up from about 20 V r.m.s.

**3.15**
**peak current ratio**
**PCR**
ratio between the peak currents and the r.m.s. currents

Note 1 to entry: For measurement procedure, see Annex G.

Note 2 to entry: This note applies to the French language only

**3.16**
**typical lamp voltage**
steady state lamp voltage expected for a lamp operating on low frequency square wave ballast

Note 1 to entry: Typical lamp current is derived from the lamp rated power and typical lamp voltage. In practice, lamps for use on low frequency square wave ballasts may be targeted to a different voltage within the allowed range for best performance, and the lamp current will be different accordingly. Typical lamp voltages and currents have been used as a basis for assigning currents at take-over and run-up.

**3.17**
**typical lamp current**
steady state lamp current expected for a lamp operating on low frequency square wave ballast

Note 1 to entry: Typical lamp current is derived from the lamp rated power and typical lamp voltage. In practice, lamps for use on low frequency square wave ballasts may be targeted to a different voltage within the allowed range for best performance, and the lamp current will be different accordingly. Typical lamp voltages and currents have been used as a basis for assigning currents at take-over and run-up.

**3.18**
**commutation time**
**fall and rise time**
transition time of lamp current at half cycle polarity reversals

Note 1 to entry: It is measured using lamp current waveforms between 90 % of the r.m.s. value of one half cycle to 90 % of the r.m.s. value of the opposite half cycle.

〔C〕 **3.Z1**
**directional lamp**
lamp having at least 80 % light output within a solid angle of π sr (corresponding to a cone with angle of 120°)

[SOURCE: Regulation 1194/2012, Article 2]

**3.Z2**
**beam angle**
the angle between two imaginary lines in a plane through the optical beam axis, such that these lines pass through the centre of the front face of the lamp and through points at which the luminous intensity is 50 % of the centre beam intensity

[SOURCE: EN 61341]

**3.Z3**
**partial luminous flux (of a light source, within a specified cone angle)**

luminous flux emitted from a light source within a specified cone angle α determined from the luminous intensity distribution $I(\theta, \varphi)$ of the source:

$$\Phi_{\alpha} = \int_{\varphi=0}^{2\pi} \int_{\theta=0}^{\alpha/2} I(\theta,\varphi) \sin\theta \, \mathrm{d}\theta \, \mathrm{d}\varphi \qquad (2)$$

Note 1 to entry: Partial luminous flux is expressed in lumen (lm).

Note 2 to entry: $(\theta, \varphi)=(0,0)$ is the direction of the cone axis.

Note 3 to entry: The cone angle α is the full angle (diameter) of the cone.

[SOURCE: EN 13032-4:2015, 3.41, modified, – Notes 4 and 5 removed]

**3.Z4**
**useful luminous flux, Φuse**
partial luminous flux of a lamp falling within the cone used for calculating the lamp's energy efficiency according Annex III, point 1.1 of regulation (EU) No 1194/2012 〔C〕

〈C〉 Note 1 to entry: Useful luminous flux is expressed in lumen (lm).

Note 2 to entry: The regulation specifies 90° or 120° cones according to the product characteristics.

Note 3 to entry: Useful luminous flux is similar to partial luminous flux. It is determined with the cone axis coincident with the observed optical beam axis of the light source, the axis about which the luminous intensity is substantially symmetrical.

**3.Z5**
**efficacy**
**'luminous efficacy of a source', 'light source efficacy' or 'lamp efficacy' (ηsource)**
the quotient of the luminous flux emitted (Φ) by the power consumed by the source (Psource). ηsource = Φ / Psource. Unit: lm/W.

The power dissipated by auxiliary equipment such as ballasts is not included in the power consumed by the source

[SOURCE: Regulation 245/2009 Annex II, 1.a)]

**3.Z6**
**Lamp Lumen Maintenance Factor (LLMF)**
the ratio of the luminous flux emitted by the lamp at a given time in its life to the initial luminous flux

[SOURCE: Regulation 245/2009 Annex II, 1.b)]

**3.Z7**
**Lamp Survival Factor (LSF)**
the fraction of the total number of lamps which continue to operate at a given time under defined conditions and switching frequency

[SOURCE: Regulation 245/2009 Annex II, 1.c)] 〈C〉

## 4 Lamp requirements

### 4.1 General

A lamp, on which compliance with this standard is claimed shall comply with the requirements of IEC 62035.

Some lamps are specified on the data sheet or declared by the manufacturer as suitable for operation on low frequency square wave ballasts only. For these lamps, separate requirements are indicated where appropriate.

A lamp shall be so designed that its performance is reliable in normal and accepted use. In general, this can be achieved by satisfying the requirements of the following subclauses.

The requirements given apply to 95 % of production.

### 4.2 Marking

A suitable advice on the colour appearance is required. It may preferably take the form of ILCOS (see IEC 61231). Other options are the manufacturer's code or the correlated colour temperature. The information may be given either on the lamp or in the supplier's catalogue.

〈C〉 Where a lamp is to be considered as a special purpose product according to Regulation (EC) No 1194/2012 this shall be declared by the supplier. 〈C〉

### 4.3 Dimensions

The dimensions of a lamp shall comply with the values specified on the relevant lamp data sheet.

### 4.4 Caps

The cap on a finished lamp shall comply with IEC 60061-1.

### 4.5 Starting and warm-up characteristics

#### 4.5.1 Lamps that may operate on electromagnetic ballasts

A lamp shall start fully within the maximum run-up time specified on the relevant lamp data sheet and remain alight. Conditions and method of test are given in Annex A.

The maximum inrush current as given on the lamp data sheet shall not be exceeded. For the test circuit and procedure, see IEC 60923.

The lamp warm-up current shall be between the minimum and maximum values as given on the lamp data sheet. Conditions and method of test are given in Annex A.

NOTE The maximum inrush current (peak) restricts the value of the current during rectification in the starting phase in order to prevent performance damages of ballast and lamp (overheating and melting of the electrodes). The minimum warm-up current is required in order to safeguard the transition from the glow phase to the arc phase.

#### 4.5.2 Lamps suitable for low frequency square wave ballasts only

A lamp shall start and run up fully within the time specified on the lamp data sheet, applying the method of test given in E.3.1.

### 4.6 Electrical characteristics

The lamp electrical characteristics shall comply with the values given in the relevant lamp data sheet. Conditions and method of test are given in Annex B.

For lamps suitable for operation on low frequency square wave ballasts only, conditions and method of test are given in Annex E. Unless otherwise specified on the lamp data sheet the lamp voltage shall comply with the limits of 75 V to 110 V.

NOTE For these lamps the power control of the ballast provides more freedom in the choice of lamp voltage to optimise the light technical properties of the lamp.

### 4.7 Photometric characteristics

The photometric requirements are as follows.

a) The initial reading of the luminous flux shall be not less than 90 % of the rated value.

b) The initial reading of the centre beam intensity of a reflector lamp shall be not less than 75 % of the rated value.

c) The initial beam angle of a reflector lamp shall be within ±25 % of the rated value for all beam angles.

d) Conditions and method of test are given in Annex B.

For lamps suitable for operation on low frequency square wave ballasts only, conditions and method of test are given in Annex E.

### 〈C〉 4.Z1 Useful luminous flux

The useful luminous flux of a directional lamp shall be measured under the conditions of Annex A or Annex E as appropriate, by luminous intensity integration as described in EN 13032-4:2015 , 6.3 “Partial luminous flux”. 〈C〉

〈C〉 Alternative measurement methods may be used if they can be shown to give equivalent results for the product being tested, if necessary by applying correction factors. Measurements with lamps operating horizontally are often much easier to carry out. The reference method, however, uses the measurement position according to A.1.

In case of doubt a goniophotometry measurement of EN 13032-4:2015, 6.3 shall be used.

NOTE Below are a few examples of alternative measurement methods. It is not an exhaustive list.

- For small beam angles shine into integrating sphere.
- Mount lamp on internal surface of integrating sphere.
- Mount lamp inside integrating sphere with screening (LM-20 technique).
- Illuminate a surface and measure the illuminance across the surface with a photometer.
- Illuminate a surface and measure the surface luminance with a luminance camera.
- Illuminate a translucent screen and measure the surface luminance of the rear side with a luminance camera. 〈C〉

### 4.8 Colour characteristics

#### 4.8.1 Lamps with non-standardised chromaticity co-ordinates

The rated values and tolerance areas shall be assigned by the manufacturer or responsible vendor.

#### 4.8.2 Lamps with standardised chromaticity co-ordinates

The correlated colour temperature and chromaticity co-ordinates applicable to a certain lamp are given on the relevant lamp data sheet. A collation is given in Table B.1.

#### 4.8.3 Colour rendering index

The initial reading of the general colour rendering index (Ra) of a lamp shall not be less than the nominal value decreased by 3.

#### 4.8.4 Requirements and test conditions

〈C〉 The chromaticity coordinates and correlated colour temperature of an individual lamp shall be calculated according to CIE 15 from a measurement made under the conditions of Annex B or Annex E as appropriate.

The colour rendering index of an individual lamp shall be calculated according to CIE 13.3 from a measurement made under the conditions of Annex B or Annex E as appropriate. 〈C〉

### 4.9 Lumen maintenance and life

Lumen maintenance and life shall comply with the data provided by the lamp manufacturer.

For methods of test, see Annex C.

〈C〉 **4.Z2**

The efficacy of an individual lamp shall be calculated from a measurement of luminous flux and power according to the conditions of Annex B or Annex E as appropriate.

**4.Z3**

The lamp lumen maintenance factor of an individual lamp shall be calculated from measurements of its luminous flux made at appropriate times according to the conditions of Annex B or Annex E as appropriate. Lamp operation between these measurements shall be as prescribed in Annex C. 〈C〉

〈C〉 **4.Z4**

The survival of an individual lamp shall be determined by operating lamps under the conditions prescribed in Annex C until the lamp fails to remain alight or delivers low light output (in case of doubt, low light output refers to noticeably less than 50 % of rated light output).

**4.Z5**

The average mercury content shall be measured in accordance with the CV AAS method as described in EN 62321-4. 〈C〉

## 5 Information for ballast, ignitor and luminaire design

In order to ensure reliable starting and operating conditions, ballasts, ignitors and luminaires should meet the requirements specified on the relevant lamp data sheet. For additional information for luminaire design, see Annex D.

IEC 60682 provides information for the measurement of the pinch temperature. Advice regarding the measurement of the bulb temperature can be taken from IEC 60357, Annex D.

These measurements should be taken account of, for performance criteria of the lamps.

For lamps with nominal power 35 W/70 W/150 W, rated power for electronic ballast design is 39 W/73 W/147 W respectively.

## 6 Data sheets

### 6.1 General principles of numbering sheets

The first number represents the number of this standard: 61167, followed by the letters “IEC”.

The second number represents the data sheet number.

The third number represents the edition of the page of the data sheet. In cases where a data sheet has more than one page, it is possible for the pages to have different edition numbers, with the data sheet number remaining the same.

### 6.2 Lists of data sheets

#### 6.2.1 List of diagrammatic lamp data sheets

Table 1 represents the listing of diagrammatic data sheets, corresponding to lamp data sheets.

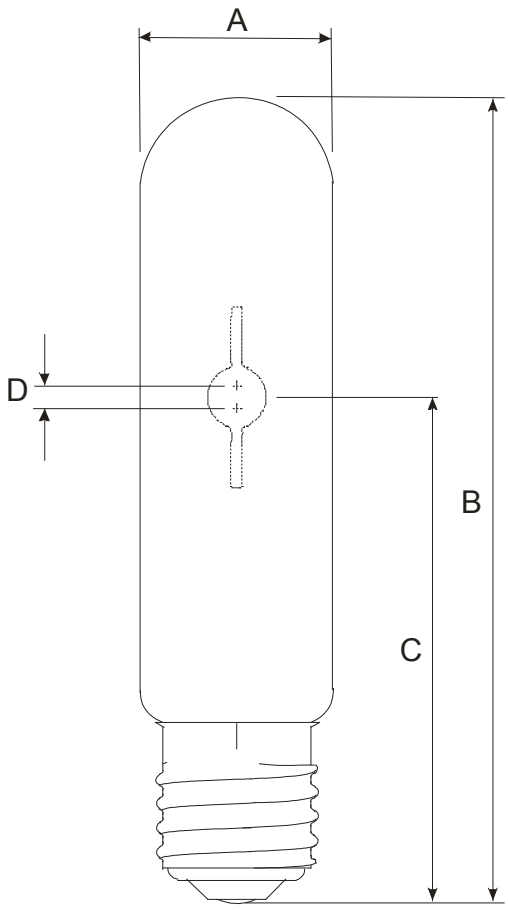
**Table 1 – List of diagrammatic lamp data sheets**

| Sheet number 61167-IEC- | Description | Cap |
|---|---|---|
| 0010 | Single-capped | E27 and E40, tubular |
| 0015 | Single-capped | E27 and E40, elliptical |
| 0020 | Single-capped | GU6.5 |
| 0025 | Single-capped | G8.5 |
| 0030 | Single-capped | GU8.5 |
| 0035 | Single-capped | G12 |
| 0210 | Reflector | E27 |
| 0215 | Reflector | GX8.5 |
| 0220 | Reflector | GX10 |
| 0110 | Double-capped | RX7s |
| 0120 | Double-capped | Fc2 |

| | DIAGRAMMATIC DATA SHEET FOR LOCATION OF SINGLE-CAPPED METAL HALIDE LAMP DIMENSIONS | Page 1 |
|---|---|---|

E27/E40 cap*, tubular bulb

*Reference plane is the bottom of the lamp.*




**Key**

A Diameter

B Distance from reference plane to bulb top = total lamp length

C Light centre length

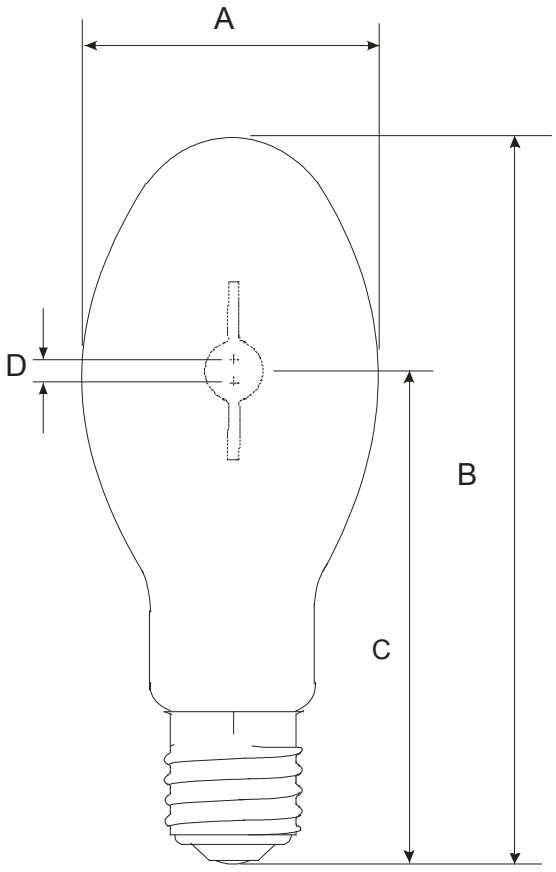
D Arc length

* See sheet 7004-21 (E27) or 7004-24 (E40) of IEC 60061-1

| | DIAGRAMMATIC DATA SHEET FOR LOCATION OF SINGLE-CAPPED METAL HALIDE LAMP DIMENSIONS | Page 1 |
|---|---|---|

E27/E40 cap*, elliptical bulb

*Reference plane is the bottom of the lamp.*




**Key**

A Diameter

B Distance from reference plane to bulb top = total lamp length

C Light centre length

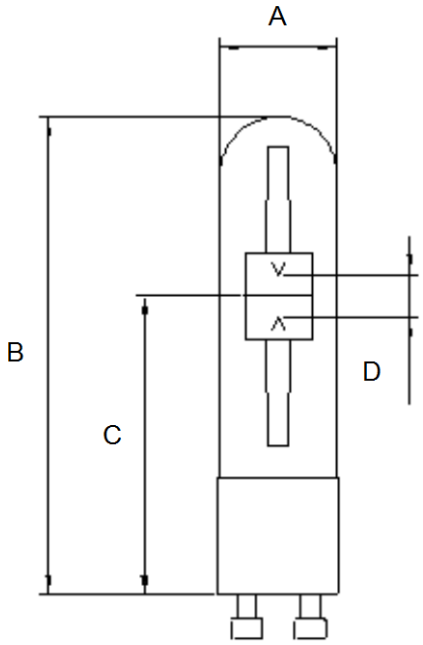
D Arc length

* See sheet 7004-21-9 (E27) or 7004-24-6 (E40) of IEC 60061-1

| | DIAGRAMMATIC DATA SHEET FOR LOCATION OF SINGLE-CAPPED METAL HALIDE LAMP DIMENSIONS | Page 1 |
|---|---|---|

GU6.5 cap*

*Reference plane is the lower cap rim.*




**Key**

A Diameter

B Distance from reference plane to bulb top

C Light centre length

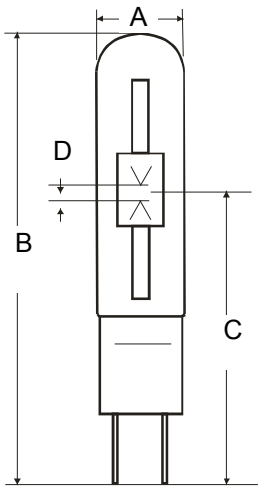
D Arc length

* See sheet 7004-152 of IEC 60061-1

| | DIAGRAMMATIC DATA SHEET FOR LOCATION OF SINGLE-CAPPED METAL HALIDE LAMP DIMENSIONS | Page 1 |
|---|---|---|

G8.5 cap*

*Reference plane is defined by the pin ends.*




**Key**

A Diameter

B Distance from reference plane to bulb top

C Light centre length

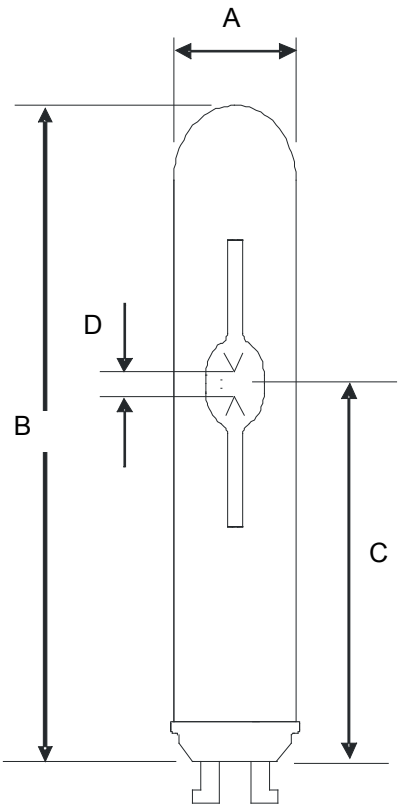
D Arc length

* See sheet 7004-122 of IEC 60061-1

| | DIAGRAMMATIC DATA SHEET<br>FOR LOCATION OF SINGLE-CAPPED<br>METAL HALIDE LAMP DIMENSIONS | Page 1 |
|---|---|---|

GU8.5 cap*

*Reference plane is the lower cap rim.*




**Key**

A Diameter

B Distance from reference plane to bulb top

C Light centre length

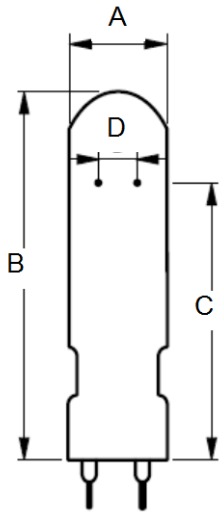
D Arc length

* See sheet 7004-166 of IEC 60061-1

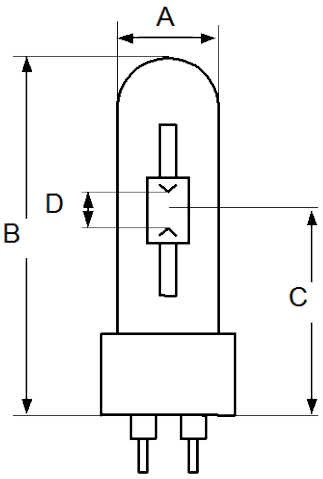
| | DIAGRAMMATIC DATA SHEET FOR LOCATION OF SINGLE-CAPPED METAL HALIDE LAMP DIMENSIONS | Page 1 |
|---|---|---|

G12 cap*

*Reference plane is the lower cap rim.*




a) Quartz arc tube, transversal arc




b) Ceramic arc tube, axial arc

**Key**

A Diameter

B Distance from reference plane to bulb top

C Light centre length

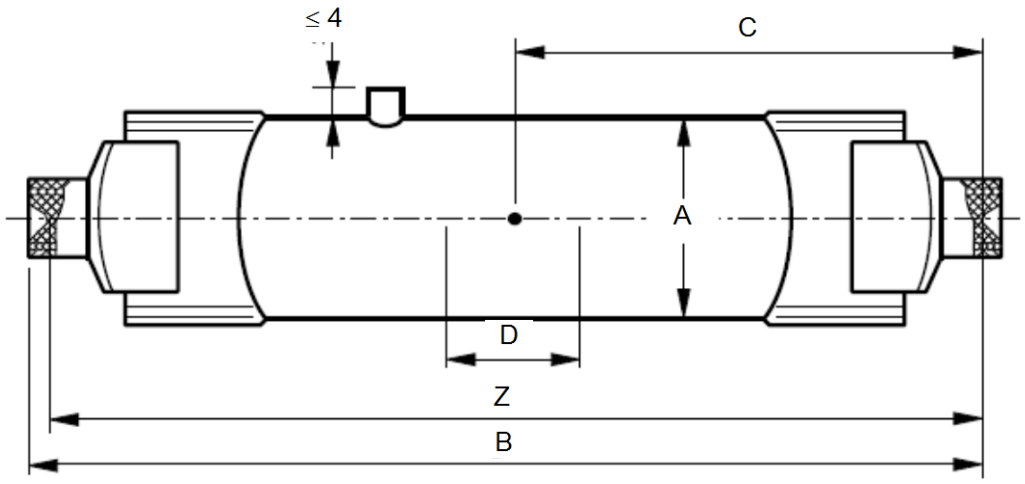
D Arc length**

* See sheet 7004-63 of IEC 60061-1

** The arc is transversal (left hand drawing), except for the lamps referred to in a footnote in the data sheets where it is axial (right hand drawing).

| | DIAGRAMMATIC DATA SHEET FOR LOCATION OF DOUBLE-CAPPED METAL HALIDE LAMP DIMENSIONS | Page 1 |
|---|---|---|

RX7s and RX7s-24 cap*




**Key**

A Diameter

B Insertion length

C Light centre length

D Arc length

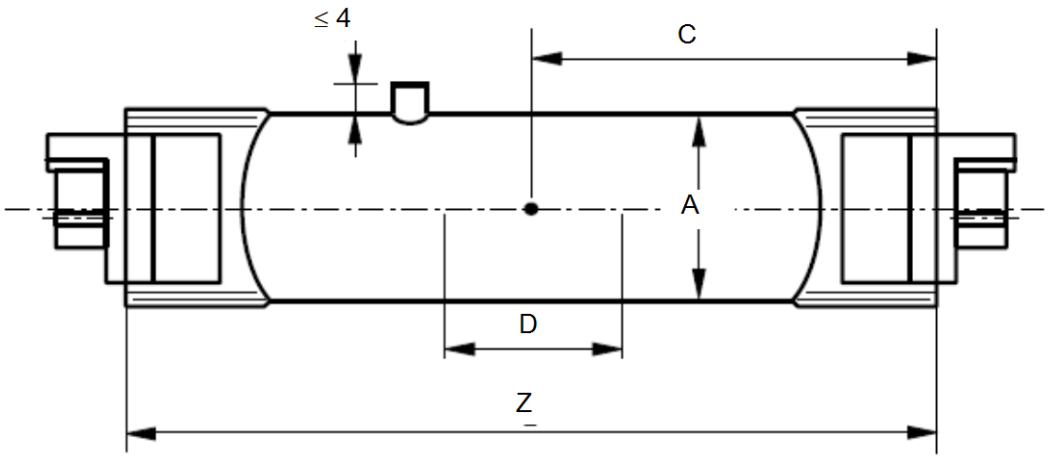
Z Contact-to-contact length

NOTE For the place of the exhaust tip, see Clause B.2.

* See sheet 7004-92A of IEC 60061-1

| | DIAGRAMMATIC DATA SHEET FOR LOCATION OF DOUBLE-CAPPED METAL HALIDE LAMP DIMENSIONS | Page 1 |
|---|---|---|

Fc2 cap*




**Key**

A Diameter

C Light centre length

D Arc length

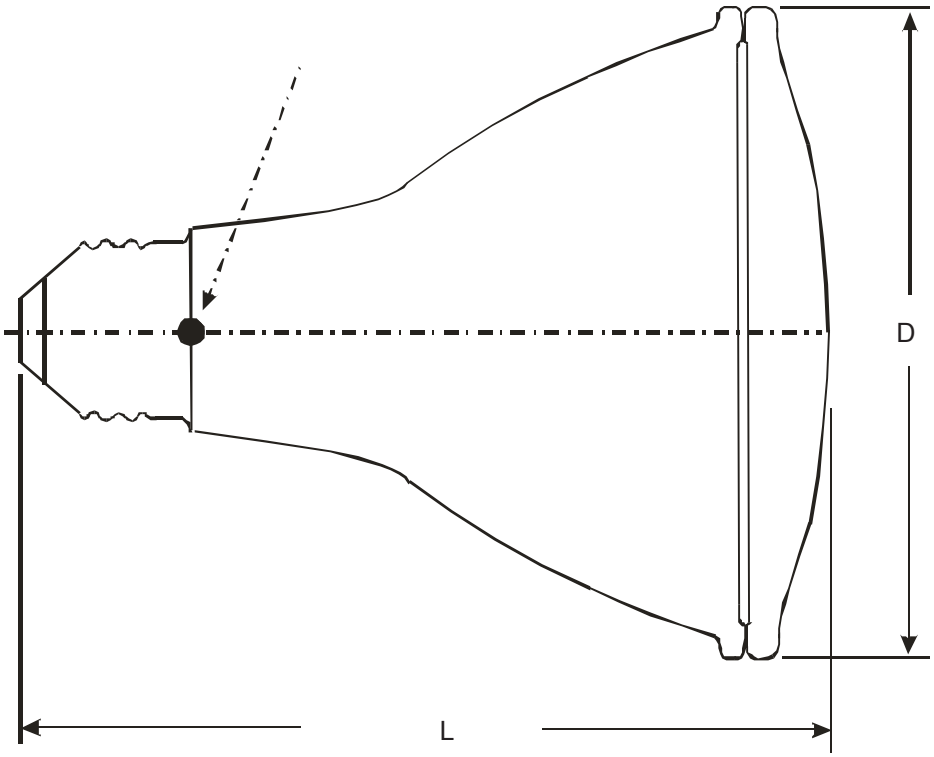
Z Distance between the two cap reference planes of the lamp

NOTE For the place of the exhaust tip see Clause B.2.

* See sheet 7004-114 of IEC 60061-1

| | DIAGRAMMATIC DATA SHEET<br>FOR LOCATION OF REFLECTOR<br>METAL HALIDE LAMP DIMENSIONS | Page 1 |
|---|---|---|

E27 cap*




The dot (arrow) marks the measuring point for cap contact temperature.

**Key**

D Diameter

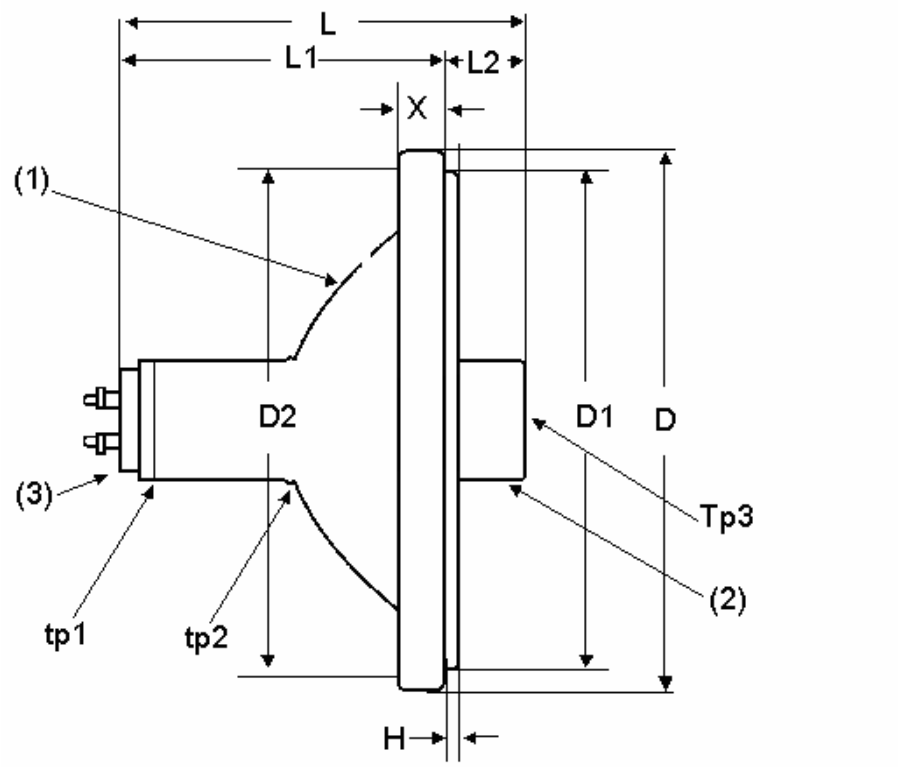
L Overall length

* See sheet 7004-21 of IEC 60061-1

# DIAGRAMMATIC DATA SHEET FOR LOCATION OF REFLECTOR METAL HALIDE LAMP DIMENSIONS

Page 1

GX8.5 cap*, 20 W, 35 W and 70 W




**Key**

(1) Metal reflector

(2) Anti-glare screen

(3) Cap GX8.5

D Lamp diameter

D1 Reflector outer rim

D2 Open diameter behind reflector rim

H Height of the reflector outer rim above X

L Overall length without pins

L1 Length from the upper corner of the reflector stop rim to cap bottom (without pins)

L2 Height of antiglare shield above the reflector outer rim

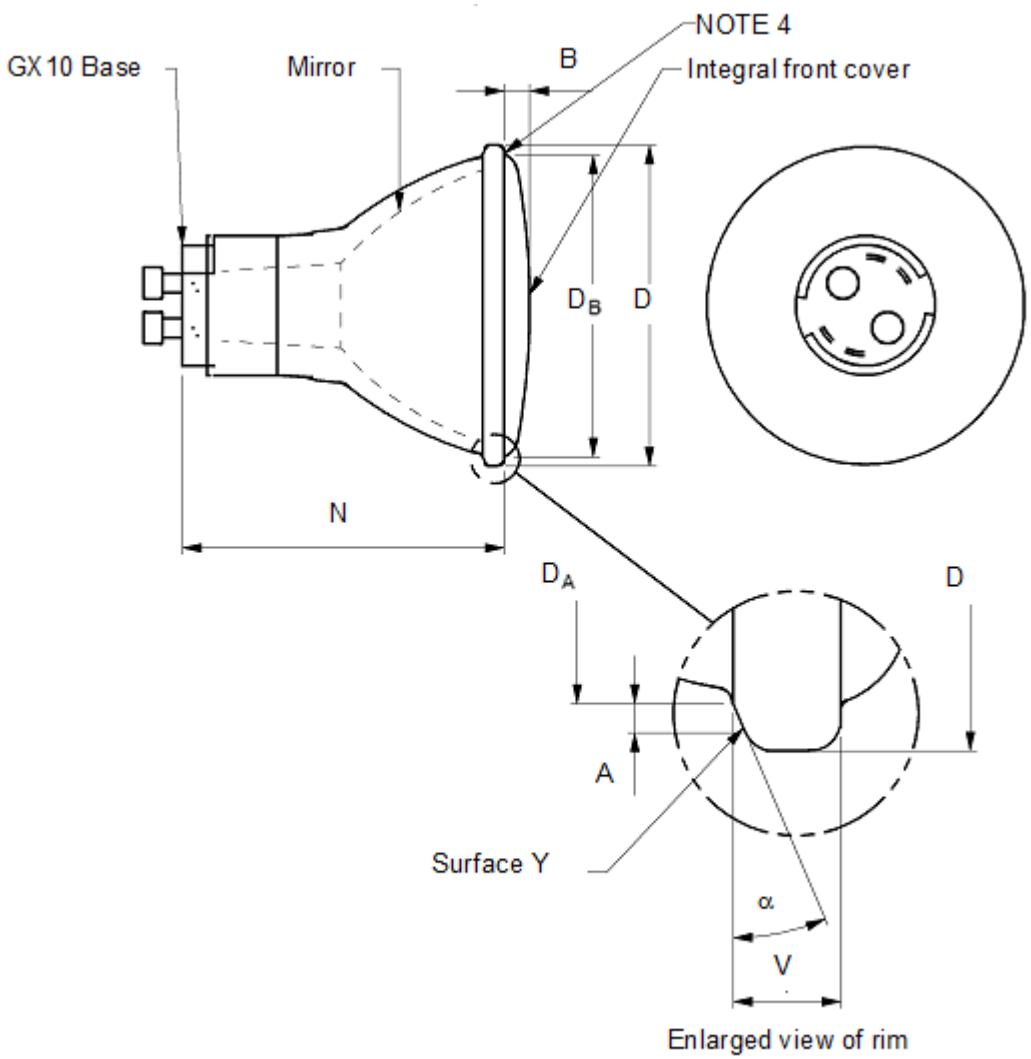
X Thickness of the reflector stop rim

Tp1, Tp2 and Tp3: temperature measurement points refer to the information for luminaire design on the relevant lamp data sheet

* See sheet 7004-143 of IEC 60061-1

| | DIAGRAMMATIC DATA SHEET<br>FOR LOCATION OF REFLECTOR<br>METAL HALIDE LAMP DIMENSIONS | Page 1 |
|---|---|---|

GX10 cap*, 20 W and 35 W




**Key**

D Lamp diameter

N Length from cap reference plane (cap without pins) to reflector rim

V is measured at $D_A$

[a] This surface is to be defined by the annulus formed by the difference between diameters D and $D_B$. It can be used to position the lamp and when so used should mate firmly with any rim-centring device to obtain proper optical alignment.

* See sheet 7004-144 of IEC 60061-1

### 6.2.2 List of lamp data sheets

Table 2 represents the listing of lamp data sheets in the order of:

– type (single-capped, reflector, double-capped);
– lamp power;
– details of cap.

**Table 2 – List of lamp data sheets**

| Sheet number 61167-IEC- | Description | Nominal power W | Cap | Correlated colour temperature K | Operation |
|---|---|---|---|---|---|
| 1020 | Single-capped | 20 | GU6.5 | 3 000 | LFSW |
| 1025 | Single-capped | 20 | G8.5 | 3 000 | LFSW |
| 1027 | Single-capped | 20 | G12 | 3 000 | LFSW |
| 1030 | Single-capped | 35 | GU6.5 | 3 000 | LFSW |
| 1035 | Single-capped | 35 | G8.5 | 3 000 | 50/60 Hz/LFSW |
| 1037 | Single-capped | 35 | G8.5 | 4 200 | 50/60 Hz/LFSW |
| 1039 | Single-capped | 35 | GU8.5 (protected) | 3 000 | LFSW |
| 1041 | Single-capped | 35 | GU8.5 (protected) | 4 200 | LFSW |
| 1043 | Single-capped | 35 | G12 | 3 000 | 50/60 Hz/LFSW |
| 1045 | Single-capped | 35 | G12 | 4 200 | 50/60 Hz/LFSW |
| 1050 | Single-capped | 50 | GU6.5 | 3 000 | LFSW |
| 1052 | Single-capped | 50 | G8.5 | 3 000 | 50/60 Hz/LFSW |
| 1054 | Single-capped | 50 | G12 | 3 000 | 50/60 Hz/LFSW |
| 1070 | Single-capped, tubular | 70 | E27 | 3 000 | 50/60 Hz/LFSW |
| 1072 | Single-capped, elliptical | 70 | E27 | 3 000 | 50/60 Hz/LFSW |
| 1074 | Single-capped, elliptical | 70 | E27 | 4 200 | 50/60 Hz/LFSW |
| 1076 | Single-capped | 70 | G8.5 | 3 000 | 50/60 Hz/LFSW |
| 1078 | Single-capped | 70 | G8.5 | 4 200 | 50/60 Hz/LFSW |
| 1080 | Single-capped | 70 | GU8.5 (protected) | 3 000 | LFSW |
| 1082 | Single-capped | 70 | GU8.5 (protected) | 4 200 | LFSW |
| 1084 | Single-capped | 70 | G12 | 3 000 | 50/60 Hz/LFSW |
| 1086 | Single-capped | 70 | G12 | 4 200 | 50/60 Hz/LFSW |
| 1100 | Single-capped, elliptical | 100 | E27 (protected) | 3 000 | 50/60 Hz/LFSW |
| 1105 | Single-capped, elliptical | 100 | E27 (protected) | 4 200 | 50/60 Hz/LFSW |
| 1110 | Single-capped | 100 | G12 | 3 000 | 50/60 Hz/LFSW |
| 1115 | Single-capped | 100 | G12 | 4 200 | 50/60 Hz/LFSW |
| 1150 | Single-capped, elliptical | 150 | E27 | 3 000 | 50/60 Hz/LFSW |
| 1152 | Single-capped, elliptical | 150 | E27 | 4 200 | 50/60 Hz/LFSW |

| Sheet number 61167-IEC- | Description | Nominal power W | Cap | Correlated colour temperature K | Operation |
|---|---|---|---|---|---|
| 1154 | Single-capped, tubular | 150 | E40 | 3 000 | 50/60 Hz/LFSW |
| 1156 | Single-capped | 150 | G12 | 3 000 | 50/60 Hz/LFSW |
| 1158 | Single-capped | 150 | G12 | 4 200 | 50/60 Hz/LFSW |
| 2015 | Reflector PAR20 | 20 | E27 | 3 000 | LFSW |
| 2020 | Reflector PAR30 | 20 | E27 | 3 000 | LFSW |
| 2022 | Reflector R111 | 20 | GX8.5 | 3 000 | LFSW |
| 2024 | Reflector MR16 | 20 | GX10 | 3 000 | LFSW |
| 2035 | Reflector PAR20 | 35 | E27 | 3 000 | 50/60 Hz/LFSW |
| 2037 | Reflector PAR30 | 35 | E27 | 3 000 | 50/60 Hz/LFSW |
| 2039 | Reflector PAR20 | 35 | E27 | 4 200 | 50/60 Hz/LFSW |
| 2041 | Reflector R111 | 35 | GX8.5 | 3 000 | 50/60 Hz/LFSW |
| 2043 | Reflector R111 | 35 | GX8.5 | 4 200 | 50/60 Hz/LFSW |
| 2045 | Reflector MR16 | 35 | GX10 | 3 000 | LFSW |
| 2050 | Reflector PAR20 | 50 | E27 | 3 000 | 50/60 Hz/LFSW |
| 2052 | Reflector PAR30 | 50 | E27 | 3 000 | 50/60 Hz/LFSW |
| 2054 | Reflector R111 | 50 | GX8.5 | 3 000 | 50/60 Hz/LFSW |
| 2056 | Reflector MR16 | 50 | GX10 | 3 000 | LFSW |
| 2070 | Reflector PAR30 | 70 | E27 | 3 000 | 50/60 Hz/LFSW |
| 2072 | Reflector PAR30 | 70 | E27 | 4 200 | 50/60 Hz/LFSW |
| 2074 | Reflector R111 | 70 | GX8.5 | 3 000 | 50/60 Hz/LFSW |
| 2076 | Reflector R111 | 70 | GX8.5 | 4 200 | 50/60 Hz/LFSW |
| 3070 | Double-capped | 70 | RX7s | 3 000 | 50/60 Hz/LFSW |
| 3075 | Double-capped | 70 | RX7s | 4 200 | 50/60 Hz/LFSW |
| 3150 | Double-capped | 150 | RX7s-24 | 3 000 | 50/60 Hz/LFSW |
| 3155 | Double-capped | 150 | RX7s-24 | 4 200 | 50/60 Hz/LFSW |
| 3250 | Double-capped | 250 | Fc2 | 4 200 | 50/60 Hz |

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 20 W | 3 000 K | Single-capped | GU6.5 |

| **Dimensions (mm)** | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nominal) |
| 13,3 | 52 | 30±2 | 3,5 |

See sheet 61167-IEC-0020.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 20 | 95 | 0,211 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 680 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | **METAL HALIDE LAMP DATA SHEET** | Page 2 |
|---|---|---|

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,0 | 5 [1] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 8 200 typical | |
| Resistance at run-up | | Ω | 62 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,30 | 0,50 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 150 V lamp voltage | | % | 80 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible lamp temperature adjacent to cap for normal lamp operation | °C | *[3] |
| Maximum permissible bulb temperature for normal lamp operation | °C | [3] |
| Maximum permissible pin temperature for normal lamp operation | °C | [3] |
| Operating position | | any |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

[1] This limit is for safety reasons.

[2] 50 to 100, exact value under consideration.

[3] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 20 W | 3 000 K | Single-capped | G8.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 17 | 85 | 52±1 | 3,5 |

See sheet 61167-IEC-0025.

| **Run-up characteristics at rated supply voltage** [1] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] [2] | | |
|---|---|---|
| Rated wattage for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 20 | 95 | 0,211 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 680 |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This lamp is suitable for operation on low frequency square wave ballasts only.

| | **METAL HALIDE LAMP DATA SHEET** | Page 2 |
|---|---|---|

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [2] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | µs/s | [1] | |
| Resistance at take-over | | Ω | 8 200 typical | |
| Resistance at run-up | | Ω | 62 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,30 | 0,50 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 150 V lamp voltage | | % | 80 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 280 * |
| Maximum permissible outer bulb temperature | °C | [3] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[1] 50 to.100, exact value under consideration

[2] This limit is for safety reasons.

[3] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* Under consideration.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 20 W | 3 000 K | Single-capped | G12 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 20 | 90 | 56±1 | 3,5 |

See sheet 61167-IEC-0035b

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90% lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 20 | 95 | 0,211 |
| This lamp is suitable for operation on low frequency square wave ballasts only. Initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 680 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [2)] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | | [3)] | |
| Resistance at take-over | | Ω | 8 200 typical | |
| Resistance at run-up | | Ω | 62 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,30 | 0,50 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 150 V lamp voltage | | % | 80 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | * |
| Maximum permissible bulb temperature | °C | [4)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

2) This limit is for safety reasons.

3) 50 to 100, exact value under consideration.

4) Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* Under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 3 000 K | Single-capped | GU6.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 13,3 | 52 | 30±2 | 5 |

See sheet 61167-IEC-0020

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90% lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| This lamp is suitable for operation on low frequency square wave ballasts only. Initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 85 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [2] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [3] | |
| Resistance at take-over | | Ω | 4 300 typical | |
| Resistance at run-up | | Ω | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,46 | 0,92 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible lamp temperature adjacent to cap for normal lamp operation | °C | [4] |
| Maximum permissible bulb temperature for normal lamp operation | °C | [4] |
| Maximum permissible pin temperature for normal lamp operation | °C | [4] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1 | | |

[2] This limit is for safety reasons.

[3] 50 to 100, exact value under consideration.

[4] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 3 000 K | Single-capped | G8.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 17 | 85 | 52±1 | 5 |

See sheet 61167-IEC-0025.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 39 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,53 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 or 60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,53 |
| Voltage/current ratio | Ω | 350 |
| Power factor | | 0,075±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 10,6 |
| Warm-up current | A | r.m.s. | 0,53 | 1,06 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 250* |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* Under consideration.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | µs/s | [2] | |
| Resistance at take-over | | Ω | 4 300 typical | |
| Resistance at run-up | | Ω | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,46 | 0,92 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 4 200 K | Single-capped | G8.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom) |
| 17 | 85 | 52±1 | 5 |

See sheet 61167-IEC-0025.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 38 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,53 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 85 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,53 |
| Voltage/current ratio | Ω | 350 |
| Power factor | | 0,075±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 10,6 |
| Warm-up current | A | r.m.s. | 0,53 | 1,06 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 300 * |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* Under consideration.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | µs/s | [2] | |
| Resistance at take-over | | Ω | 4 300 typical | |
| Resistance at run-up | | Ω | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,46 | 0,92 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration.

[3] This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 3 000 K | Single-capped<br>Self-protected | GU8.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.)* | B (max.) | C | D (nom.) |
| 23 | 92 | 51,5±1 | 5 |

See sheet 61167-IEC-0030-1.

* Existing luminaire designs in Japan may be limited to 22 mm.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1) 2)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

1) Values after 100 h ageing. Test position: vertical cap-up ±5°.

2) This lamp is suitable for operation on low frequency square wave ballasts only.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [1] | |
| Resistance at take-over | | Ω | 4 300 typical | |
| Resistance at run-up | | Ω | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,46 | 0,92 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature adjacent to cap for normal lamp operation | °C | [3] |
| Maximum permissible outer bulb temperature for normal lamp operation | °C | [3] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

[1] 50 to 100, exact value under consideration.

[2] This limit is for safety reasons.

[3] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 4 200 K | Single-capped<br>Self-protected | GU8.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.)* | B (max.) | C | D (nom.) |
| 23 | 92 | 51,5±1 | 5 |

See sheet 61167-IEC-0030-1.

* Existing luminaire designs in Japan may be limited to 22 mm.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1) 2)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

1) Values after 100 h ageing. Test position: vertical cap-up ±5°.

2) This lamp is suitable for operation on low frequency square wave ballasts only.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [1] | |
| Resistance at take-over | | Ω | 4 300 typical | |
| Resistance at run-up | | Ω | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,46 | 0,92 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature adjacent to cap for normal lamp operation | °C | [3] |
| Maximum permissible outer bulb temperature for normal lamp operation | °C | [3] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

[1] 50 to 100, exact value under consideration

[2] This value is for safety reasons.

[3] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 3 000 K | Single-capped | G12 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 20 | 90 | 56±1 | 5 |

See sheet 61167-IEC-0035b.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 39 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,53 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 or 60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,53 |
| Voltage/current ratio | Ω | 350 |
| Power factor | | 0,075±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 10,6 |
| Warm-up current | A | r.m.s. | 0,53 | 1,06 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 280* |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* Under consideration.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [3] | |
| | Ceramic arc tubes only | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [3] | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | µs/s | [4] | |
| Resistance at take-over | | | Ω | 4 300 typical | |
| Resistance at run-up | | | Ω | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 0,46 | 0,92 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 10 | 1 000 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 4 200 K | Single-capped | G12 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 20 | 90 | 56±1 | 5 |

See sheet 61167-IEC-0035b

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 38 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,53 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 85 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,53 |
| Voltage/current ratio | Ω | 350 |
| Power factor | | 0,075±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 10,6 |
| Warm-up current | A | r.m.s. | 0,53 | 1,06 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 300 * |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* Under consideration.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [3] | |
| | Ceramic arc tubes only | | | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [3] | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | | [4] | |
| Resistance at take-over | | Ω | | 4 300 typical | |
| Resistance at run-up | | Ω | | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | A | | 0,46 | 0,92 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | kHz | | 10 | 1 000 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | % | | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 50 W | 3 000 K | Single-capped | GU6.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 13,3 | 52 | 30±2 | 6 |

See sheet 61167-IEC-0020.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 50 | 85 | 0,59 |
| This lamp is suitable for operation on low frequency square wave ballasts only. Initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 90 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 272 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [2)] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [3)] | |
| Resistance at take-over | | Ω | 3 300 typical | |
| Resistance at run-up | | Ω | 22 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,59 | 1,18 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible lamp temperature adjacent to cap for normal lamp operation | °C | [4)] |
| Maximum permissible bulb temperature for normal lamp operation | °C | [4)] |
| Maximum permissible pin temperature for normal lamp operation | °C | [4)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a safety screen. For requirements see IEC 60598-1. | | |

[2)] This limit is for safety reasons.

[3)] 50 to 100, exact value under consideration.

[4)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 50 W | 3 000 K | Single-capped | G8.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 17 | 85 | 52±1 | 6 |

See sheet 61167-IEC-0025.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 53 | | |
| Voltage | V | 87 | 80 | 105 |
| Current | A | 0,76 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 90 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,76 |
| Voltage/current ratio | Ω | 246 |
| Power factor | | 0,075±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 15,2 |
| Warm-up current | A | r.m.s. | 0,76 | 1,52 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | * |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 50 | 85 | 0,59 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 272 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | µs/s | [2] | |
| Resistance at take-over | | Ω | 3 300 typical | |
| Resistance at run-up | | Ω | 22 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,59 | 1,18 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 50 W | 3 000 K | Single-capped | G12 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 20 | 90 | 56±1 | 6 |

See sheet 61167-IEC-0035b

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 53 | | |
| Voltage | V | 87 | 80 | 105 |
| Current | A | 0,76 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 90 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,76 |
| Voltage/current ratio | Ω | 246 |
| Power factor | | 0,075±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 15,2 |
| Warm-up current | A | r.m.s. | 0,76 | 1,52 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | * |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 50 | 85 | 0,59 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 272 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 3 300 typical | |
| Resistance at run-up | | Ω | 22 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,59 | 1,18 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 3 000 K | Single-capped, tubular | E27 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 39 | 156 | 102±3 | 7 |

See sheet 61167-IEC-0010.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 73 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible outer bulb temperature | °C | 320 * |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 1,8 | 5 [3] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 2 200 typical | |
| Resistance at run-up | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,86 | 1,72 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** [2), 3)] | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 3 000 K | Single-capped, elliptical<br>Self-protected | E27 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 57 | 144 | 89±5 | 7 [3)] |

See sheet 61167-IEC-0015

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 75 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | [2)] |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2)] Lamps according to this data sheet can have different CRI values depending on the technology used. See the published ILCOS code or manufacturer's data for the exact value.

[3)] This data sheet is relevant for both coated and clear lamps. The arc length D is not relevant for coated lamps.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible outer bulb temperature | °C | [1)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

[1)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | μs/s | 250 [3] | |
| | Ceramic arc tubes only | | μs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | μs/s | 250 [3] | |
| pulse width at 90% peak, option (2) with 30 s@b | | b = | μs/s | [4] | |
| Resistance at take-over | | | Ω | 2 200 typical | |
| Resistance at run-up | | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 0,86 | 1,72 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 10 | 1 000 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5.

[2] This limit is for safety reasons.

[3] In Japan, 100 μs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** [2), 3), 4)] | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 4 200 K | Single-capped, elliptical<br>Self-protected | E27 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 57 | 144 | 89±5 | 7[4)] |

See sheet 61167-IEC-0015.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 75 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal)** [1) 2)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | [3)] |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

1) Values after 100 h ageing. Test position: vertical cap-up ±5°.

2) Some manufacturers have lamps with differing colour targets. See the manufacturer's data for the exact value.

3) Lamps according to this data sheet can have different CRI values depending on the technology used. See the published ILCOS code or manufacturer's data for the exact value.

4) This data sheet is relevant for both coated and clear lamps. The arc length D is not relevant for coated lamps.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible outer bulb temperature | °C | [1)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

[1)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [3] | |
| | Ceramic arc tubes only | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [3] | |
| pulse width at 90% peak, option (2) with 30 s@b | | b = | µs/s | [4] | |
| Resistance at take-over | | | Ω | 2 200 typical | |
| Resistance at run-up | | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 0,86 | 1,72 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 10 | 1 000 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 3 000 K | Single-capped | G8.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 17 | 85 | 52±1 | 7 |

See sheet 61167-IEC-0025.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 73 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 300 * |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | µs/s | [2] | |
| Resistance at take-over | | Ω | 2 200 typical | |
| Resistance at run-up | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,86 | 1,72 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 4 200 K | Single-capped | G8.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 17 | 85 | 52±1 | 5 |

See sheet 61167-IEC-0025.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 73 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 90 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 300 * |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 2 200 typical | |
| Resistance at run-up | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,86 | 1,72 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration.

[3] This limit is for safety reasons.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 3 000 K | Single-capped<br>Self-protected | GU8.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.)* | B (max.) | C | D (nom.) |
| 23 | 92 | 51,5±1 | 6 |

See sheet 61167-IEC-0030-1.

* Existing luminaire designs in Japan may be limited to 22 mm.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1) 2)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

1) Values after 100 h ageing. Test position: vertical cap-up ±5°.

2) This lamp is suitable for operation on low frequency square wave ballasts only.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [1] | |
| Resistance at take-over | | Ω | 2 200 typical | |
| Resistance at run-up | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,86 | 1,72 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature adjacent to cap for normal lamp operation | °C | [3] |
| Maximum permissible outer bulb temperature for normal lamp operation | °C | [3] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

[1] 50 to 100, exact value under consideration.

[2] This limit is for safety reasons.

[3] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 4 200 K | Single-capped<br>Self-protected | GU8.5 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.)* | B (max.) | C | D (nom.) |
| 23 | 92 | 51,5±1 | 6 |

See sheet 61167-IEC-0030-1.

* Existing luminaire designs in Japan may be limited to 22 mm.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1) 2)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

1) Values after 100 h ageing. Test position: vertical cap-up ±5°.

2) This lamp is suitable for operation on low frequency square wave ballasts only.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [1] | |
| Resistance at take-over | | Ω | 2 200 typical | |
| Resistance at run-up | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,86 | 1,72 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature adjacent to cap for normal lamp operation | °C | [3] |
| Maximum permissible outer bulb temperature for normal lamp operation | °C | [3] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

[1] 50 to 100, exact value under consideration

[2] This limit is for safety reasons.

[3] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 3 000 K | Single-capped | G12 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 26 | 76 | 56±1 | 4 |

See sheet 61167-IEC-0035a.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 75 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 or 60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

NOTE There are also lamp designs with a maximum dimension B of 90 mm and an axially positioned arc with a nominal length D of 7 mm, see 61167-IEC-0035b.

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 280* |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [3] | |
| | Ceramic arc tubes only | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [3] | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | µs/s | [4] | |
| Resistance at take-over | | | Ω | 2 200 typical | |
| Resistance at run-up | | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 0,86 | 1,72 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 10 | 1 000 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 4 200 K* | Single-capped | G12 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 26 | 76 | 56±1 | 4,5 |

See sheet 61167-IEC-0035a.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 75 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 or 60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

NOTE There are also lamp designs with a maximum dimension B of 90 mm and an axially positioned arc with a nominal length D of 7 mm, see 61167-IEC-0035b.

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

* under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 280* |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power<br>W | Typical voltage<br>V | Typical current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | μs/s | 250 [3] | |
| | Ceramic arc tubes only | | | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with<br>pulse width at 90 % peak, option (2) with 30 s@b | Ceramic and quartz arc tubes | a = | μs/s | 250 [3] | |
| | | b = | | [4] | |
| Resistance at take-over | | | Ω | 2 200 typical | |
| Resistance at run-up | | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 0,86 | 1,72 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 10 | 1 000 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] In Japan, 100 μs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 100 W | 3 000 K | Single-capped, elliptical<br>Self-protected | E27 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 57 | 144 | 89±5 | 10 [4)] |

See sheet 61167-IEC-0015.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 96 | | |
| Voltage | V | 95 | 85 | 110 |
| Current | A | 1,2 | | |

| **Colour characteristics (nominal)** [1) 2)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 90 [3)] |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 |
| Rated voltage | V | 220 |
| Calibration current | A | 1,2 |
| Voltage/current ratio | Ω | 148 |
| Power factor | | 0,06±0,005 |

1) Values after 100 h ageing. Test position: vertical cap-up ±5°.

2) Some manufacturers have lamps with differing colour targets. See the manufacturer's data for the exact value.

3) Lamps according to this data sheet can have different CRI values depending on the technology used. See the published ILCOS code or manufacturer's data for the exact value.

4) This data sheet is relevant for both coated and clear lamps. The arc length D is not relevant for coated lamps.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 24 |
| Warm-up current | A | r.m.s. | 1,2 | 2,4 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible outer bulb temperature | °C | * |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 100 | 90 | 1,11 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 136 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 1 800 typical | |
| Resistance at run-up | | Ω | 13 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 1,11 | 2,22 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 100 W | 4 200 K | Single-capped, elliptical<br>Self-protected | E27 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 57 | 144 | 89±5 | 10 [4)] |

See sheet 61167-IEC-0015.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 96 | | |
| Voltage | V | 95 | 85 | 110 |
| Current | A | 1,2 | | |

| **Colour characteristics (nominal)** [1) 2)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 90 [3)] |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 |
| Rated voltage | V | 220 |
| Calibration current | A | 1,2 |
| Voltage/current ratio | Ω | 148 |
| Power factor | | 0,06±0,005 |

1) Values after 100 h ageing. Test position: vertical cap-up ±5°.

2) Some manufacturers have lamps with differing colour targets. See the manufacturer's data for the exact value.

3) Lamps according to this data sheet can have different CRI values depending on the technology used. See the published ILCOS code or manufacturer's data for the exact value.

4) This data sheet is relevant for both coated and clear lamps. The arc length D is not relevant for coated lamps.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 24 |
| Warm-up current | A | r.m.s. | 1,2 | 2,4 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible outer bulb temperature | °C | * |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 100 | 90 | 1,11 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 136 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 1 800 typical | |
| Resistance at run-up | | Ω | 13 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 1,11 | 2,22 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 100 W | 3 000 K | Single-capped | G12 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 21 | 100 | 56±1 | 10 |

See sheet 61167-IEC-0035b.

| **Run-up characteristics at rated supply voltage** [1] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 96 | | |
| Voltage | V | 95 | 85 | 110 |
| Current | A | 1,2 | | |

| **Colour characteristics (nominal)** [1] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 |
| Rated voltage | V | 220 |
| Calibration current | A | 1,2 |
| Voltage/current ratio | Ω | 148 |
| Power factor | | 0,06±0,005 |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 24 |
| Warm-up current | A | r.m.s. | 1,2 | 2,4 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | * |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 100 | 90 | 1,11 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 136 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3)] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | | [2)] | |
| Resistance at take-over | | Ω | 1 800 typical | |
| Resistance at run-up | | Ω | 13 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 1,11 | 2,22 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

1) Values after 100 h ageing. Test position: vertical cap-up ±5°.

2) 50 to 100, exact value under consideration

3) This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 100 W | 4 200 K | Single-capped | G12 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 21 | 100 | 56±1 | 10 |

See sheet 61167-IEC-0035b.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 96 | | |
| Voltage | V | 95 | 85 | 110 |
| Current | A | 1,2 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 90 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 |
| Rated voltage | V | 220 |
| Calibration current | A | 1,2 |
| Voltage/current ratio | Ω | 148 |
| Power factor | | 0,06±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 24 |
| Warm-up current | A | r.m.s. | 1,2 | 2,4 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | * |
| Maximum permissible outer bulb temperature | °C | 2) |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements see IEC 60598-1. | | |

2) Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 100 | 90 | 1,11 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 136 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 1 800 typical | |
| Resistance at run-up | | Ω | 13 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 1,11 | 2,22 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 150 W | 3 000 K | Single-capped, elliptical<br>Self-protected | E27 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 57 | 144 | 89±5 | 10[3)] |

See sheet 61167-IEC-0015

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 148 * | | |
| Voltage | V | 95 | 80 | 110 |
| Current | A | 1,8 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | [2)] |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 1,8 |
| Voltage/current ratio | Ω | 99/97 |
| Power factor | | 0,06/0,075±0,005 |

* under consideration

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2)] Lamps according to this data sheet can have different CRI values depending on the technology used. See the published ILCOS code or manufacturer's data for the exact value.

[3)] This data sheet is relevant for both coated and clear lamps. The arc length D is not relevant for coated lamps.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 36 |
| Warm-up current | A | r.m.s. | 1,8 | 3,2 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible outer bulb temperature | °C | [1)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

[1)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 147 | 90 | 1,63 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 97 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [3] | |
| | Ceramic arc tubes only | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [3] | |
| pulse width at 90% peak, option (2) with 30 s@b | | b = | µs/s | [4] | |
| Resistance at take-over | | | Ω | 1 100 typical | |
| Resistance at run-up | | | Ω | 8,2 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 1,63 | 3,27 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 8 | 400 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] The limit is for safety reasons.

[3] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 150 W | 4 200 K | Single-capped, elliptical<br>Self-protected | E27 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 57 | 144 | 89±5 | 10 [3)] |

See sheet 61167-IEC-0015.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 148 * | | |
| Voltage | V | 95 | 80 | 110 |
| Current | A | 1,8 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | [2)] |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 1,8 |
| Voltage/current ratio | Ω | 99/97 |
| Power factor | | 0,06/0,075±0,005 |

* under consideration

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2)] Lamps according to this data sheet can have different CRI values depending on the technology used. See the published ILCOS code or manufacturer's data for the exact value.

[3)] This data sheet is relevant for both coated and clear lamps. The arc length D is not relevant for coated lamps.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 36 |
| Warm-up current | A | r.m.s. | 1,8 | 3,2 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible outer bulb temperature | °C | [1)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

[1)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 147 | 90 | 1,63 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 97 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [3] | |
| | Ceramic arc tubes only | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [3] | |
| pulse width at 90% peak, option (2) with 30 s@b | | b = | µs/s | [4] | |
| Resistance at take-over | | | Ω | 1 100 typical | |
| Resistance at run-up | | | Ω | 8,2 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 1,63 | 3,27 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 8 | 400 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 150 W | 3 000 K | Single-capped, tubular | E40 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 48 | 211 | 132±3 | 10 |

See sheet 61167-IEC-0010.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 148 | | |
| Voltage | V | 95 | 80 | 110 |
| Current | A | 1,8 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 1,8 |
| Voltage/current ratio | Ω | 99/97 |
| Power factor | | 0,06/0,075±0,005 |

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 36 |
| Warm-up current | A | r.m.s. | 1,8 | 3,2 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 250 |
| Maximum permissible outer bulb temperature | °C | 400 |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 147 | 90 | 1,63 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 97 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [3] | |
| | Ceramic arc tubes only | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [3] | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | µs/s | [4] | |
| Resistance at take-over | | | Ω | 1 100 typical | |
| Resistance at run-up | | | Ω | 8,2 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 1,63 | 3,27 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 8 | 400 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 150 W | 3 000 K | Single-capped | G12 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 26 | 76 | 56±1 | 6,3 |

See sheet 61167-IEC-0035a.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 146 | | |
| Voltage | V | 95 | 80 | 110 |
| Current | A | 1,82 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | | |
|---|---|---|---|
| Rated frequency | Hz | 50 | 60 |
| Rated voltage | V | 220 | 220 |
| Calibration current | A | 1,8 | 1,8 |
| Voltage/current ratio | Ω | 99 | 97 |
| Power factor | | 0,060±0,005 | 0,075±0,005 |

NOTE There are also lamp designs with a maximum dimension B of 100 mm and an axially positioned arc with a nominal length D of 9 mm, see 61167-IEC-0035b.

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 36,0 |
| Warm-up current | A | r.m.s. | 1,8 | 3,2 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 280* |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 6 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 147 | 90 | 1,63 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 97 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [3] | |
| | Ceramic arc tubes only | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [3] | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | µs/s | [4] | |
| Resistance at take-over | | | Ω | 1 100 typical | |
| Resistance at run-up | | | Ω | 8,2 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 1,63 | 3,27 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 8 | 400 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 150 W | 4 200 K* | Single-capped | G12 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | B (max.) | C | D (nom.) |
| 26 | 76 | 56±1 | 6,3 |

See sheet 61167-IEC-0035a.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 146 | | |
| Voltage | V | 95 | 80 | 110 |
| Current | A | 1,82 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | | |
|---|---|---|---|
| Rated frequency | Hz | 50 | 60 |
| Rated voltage | V | 220 | 220 |
| Calibration current | A | 1,8 | 1,8 |
| Voltage/current ratio | Ω | 99 | 97 |
| Power factor | | 0,060±0,005 | 0,075±0,005 |

NOTE There are also lamp designs with a maximum dimension B of 100 mm and an axially positioned arc with a nominal length D of 9 mm, see 61167-IEC-0035b.

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

* under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 36,0 |
| Warm-up current | A | r.m.s. | 1,8 | 3,2 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 280* |
| Maximum permissible outer bulb temperature | °C | [2)] |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 6 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[2)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 147 | 90 | 1,63 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 97 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [3] | |
| | Ceramic arc tubes only | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [3] | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | µs/s | [4] | |
| Resistance at take-over | | | Ω | 1 100 typical | |
| Resistance at run-up | | | Ω | 8,2 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 1,63 | 3,27 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 8 | 400 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 20 W | 3 000 K | Reflector PAR20<br>Self-protected | E27 |

| **Dimensions** (mm) | |
|---|---|
| D (Rated) | L (Maximum) |
| 63,5 | 96 |

See sheet 61167-IEC-0210.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90% lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 20 | 95 | 0,211 |
| This lamp is suitable for operation on low frequency square wave ballasts only. Initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 680 |

* Lamps are made with various beam angles.

1) Values after 100 h ageing. Test position: vertical cap-up ±5°

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | kV peak | 3 | 5 [2] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | | [3] | |
| Resistance at take-over | | Ω | 8 200 typical | |
| Resistance at run-up | | Ω | 62 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,30 | 0,50 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 150 V lamp voltage | | % | 80 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible bulb temperature (neck/reflector interface) | °C | 300 |
| Maximum permissible temperature at lens/reflector interface | °C | 160 |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

[2] This limit is for safety reasons.

[3] 50 to 100, exact value under consideration.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 20 W | 3 000 K | Reflector PAR30<br>Self-protected | E27 |

| **Dimensions** (mm) | |
|---|---|
| D (Rated) | L (Maximum) |
| 95 [4] | 125 |

See sheet 61167-IEC-0210.

| **Run-up characteristics at rated supply voltage** [1] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] [2] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 20 | 95 [3] | 0,211 [3] |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 680 |

* Lamps are made with various beam angles.

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This lamp is suitable for operation on low frequency square wave ballasts only.

[3] Manufacturers may have different target values for lamp voltage and the current will vary accordingly.

[4] Some manufacturers use reflectors up to 96,8 mm outer diameter.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [2] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [1] | |
| Resistance at take-over | | Ω | 8 200 typical | |
| Resistance at run-up | | Ω | 62 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,30 | 0,50 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible bulb temperature (neck/reflector interface) | °C | 300 |
| Maximum permissible temperature at lens/reflector interface | °C | 160 |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

[1] 50 to 100, exact value under consideration

[2] This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 20 W | 3 000 | Reflector R111<br>Self-protected | GX8.5 |

| **Dimensions** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | | |
| D[1)] | | D1[1)] | D2[1)] | | H[1)] | | X[1)] | | L | L1 | L2 |
| Min. | Max. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Max. | Max. | Max. |
| 110,4 | 111 | 103 | 106 | 107,2 | 1,8 | 6 | 5 | 10 | 88 | 70 | 20 |

See sheet 61167-IEC-0215.

1) These dimensions are identical to those on sheet 60357-IEC-6450.

| **Run-up characteristics at rated supply voltage** [2)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [2)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 20 | 95 | 0,21 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [2)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast**[3)] (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 680 |

* Lamps are made with various beam angles.

2) Values after 100 h ageing. Test position: Vertical cap-up ±5°.

3) under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| **Superimposed ignition** | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,0 | 5,0 [1] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 8 200 typical | |
| Resistance at run-up | | Ω | 62 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,30 | 0,50 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 150 V lamp voltage | | % | 80 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | | |
|---|---|---|---|
| Maximum permissible temperature (Tp1) at cap rim | °C | Lamp operating temperatures can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply. | |
| Maximum permissible temperature (Tp2) at reflector neck | °C | | |
| Maximum permissible temperature (Tp3) at top of anti-glare screen | °C | | |
| Operating position | | any | |
| Maximum specific effective radiant UV power of the lamp | | $mW/(m^2\ klx)$ | 2 |

[1] This limit is for safety reasons.

[2] 50 to 100, exact value under consideration

# METAL HALIDE LAMP
# DATA SHEET *

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| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 20 W | 3 000 | Reflector MR16<br>Self-protected | GX10 |

| **Dimensions** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | ° |
| A | B | D (1) | | $D_A$ (2) | $D_B$ | N | | V (3) | | α |
| Min. | Max. | Min. | Max. | | Max. | Min. | Max. | Min. | Max. | Max. |
| 0,3 | 4,5 | 49,4 | 50,7 | 48 | 48 | 51 | 54,5 | 1,4 | 4,8 | 60 |

See sheet 61167-IEC-0220.

(1) Allowable maximum diameter includes mould flash and out-of-roundness.

(2) The dimension $D_A$ indicates the inner diameter of the surface Y which has a minimum width of A and can be inclined up to an angle of α.

(3) V is measured at $D_A$.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 20 | 95 | 0,211 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 680 |

* Lamps are made with various beam angles.

[1)] Values after 100 h ageing. Test position: Vertical cap-up ±5°.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,0 | 5 [1] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 8 200 typical | |
| Resistance at run-up | | Ω | 62 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,30 | 0,50 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 150 V lamp voltage | | % | 80 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for luminaire design** | | | |
|---|---|---|---|
| Maximum permissible lamp temperature adjacent to cap for normal lamp operation | °C | Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply. | |
| Maximum permissible bulb temperature for normal lamp operation | °C | | |
| Maximum permissible pin temperature for normal lamp operation | °C | | |
| Operating position | | | |
| Maximum specific effective radiant UV power of the lamp | | $mW/(m^2\ klx)$ | 2 |

[1] This limit is for safety reasons.

[2] 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 3 000 | Reflector PAR20<br>Self-protected | E27 [1)] |

| **Dimensions** (mm) | |
|---|---|
| D | L |
| Rated | Maximum |
| 63,5 [2)] | 96 |

See sheet 61167-IEC-0210.

| **Run-up characteristics at rated supply voltage** [3)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [3)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 39 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,53 | | |

| **Colour characteristics (nominal)** [3)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 82 |

| **Reference ballast characteristics** | | | |
|---|---|---|---|
| Rated frequency | Hz | 50 | 60 |
| Rated voltage | V | 220 | 220 |
| Calibration current | A | 0,53 | 0,53 |
| Voltage/current ratio | Ω | 350 | 350 |
| Power factor | | 0,075±0,005 | 0,075±0,005 |

* Lamps are made with various beam angles.

1) For cap dimensions see data sheet 7004-21 of IEC 60061-1.

2) Some manufacturers use reflectors up to 65,3 mm outer diameter.

3) Values after 100 h ageing. Test position: Vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | - | 10,6 |
| Warm-up current | A | r.m.s. | 0,53 | 1,06 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible bulb temperature (neck/reflector interface) | °C | 300 |
| Maximum permissible temperature at lens/reflector interface | °C | 160 |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,5 | 5 [3] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 4 300 typical | |
| Resistance at run-up | | Ω | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,46 | 0,92 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap [1] |
|---|---|---|---|
| 35 W | 3 000 | Reflector PAR30<br>Self-protected | E27 |

| **Dimensions** (mm) | |
|---|---|
| D | L |
| Rated | Maximum |
| 95 [2] | 125 |

See sheet 61167-IEC-0210.

| **Run-up characteristics at rated supply voltage** [3] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [3] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 39 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,53 | | |

| **Colour characteristics (nominal)** [3] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 82 |

| **Reference ballast characteristics** | | | |
|---|---|---|---|
| Rated frequency | Hz | 50 | 60 |
| Rated voltage | V | 220 | 220 |
| Calibration current | A | 0,53 | 0,53 |
| Voltage/current ratio | Ω | 350 | 350 |
| Power factor | | 0,075±0,005 | 0,075±0,005 |

* Lamps are made with various beam angles.

[1] For cap dimensions see data sheet 7004-21 of IEC 60061-1.

[2] Some manufacturers use reflectors up to 96,8 mm outer diameter.

[3] Values after 100 h ageing. Test position: Vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | - | 10,6 |
| Warm-up current | A | r.m.s. | 0,53 | 1,06 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible bulb temperature (neck/reflector interface) | °C | 300 |
| Maximum permissible temperature at lens/reflector interface | °C | 160 |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,5 | 5 [3] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 4 300 typical | |
| Resistance at run-up | | Ω | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,46 | 0,92 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50…100, exact value under consideration

[3] This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 4 200 K | Reflector PAR20<br>Self-protected | E27 |

| **Dimensions** (mm) | |
|---|---|
| D | L |
| Rated | Maximum |
| 63,5 | 96 |

See sheet 61167-IEC-0210.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 39 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,53 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 90 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,53 |
| Voltage/current ratio | Ω | 350 |
| Power factor | | 0,075±0,005 |

* Lamps are made with various beam angles.

1) Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 10,6 |
| Warm-up current | A | r.m.s. | 0,53 | 1,06 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible bulb temperature (neck/reflector interface) | °C | 300 |
| Maximum permissible temperature at lens/reflector interface | °C | 160 |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [3] |
| | Ceramic arc tubes only | | | 3,0 | 5 [3] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [4] | |
| | Ceramic arc tubes only | | | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [4] | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | | [2] | |
| Resistance at take-over | | Ω | | 4 300 typical | |
| Resistance at run-up | | Ω | | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | A | | 0,46 | 0,92 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | kHz | | 10 | 1 000 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | % | | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

[4] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

# METAL HALIDE LAMP
# DATA SHEET *

Page 1

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 3 000 | Reflector R111<br>Self-protected | GX8.5 |

| Dimensions | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | | |
| D[1)] | | D1[1)] | D2[1)] | | H[1)] | | X[1)] | | L | L1 | L2 |
| Min. | Max. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Max. | Max. | Max. |
| 110,4 | 111 | 103 | 106 | 107,2 | 1,8 | 6 | 5 | 10 | 88 | 70 | 20 |

See sheet 61167-IEC-0215.

[1)] These dimensions are identical to those on sheet 60357-IEC-6450.

| Run-up characteristics at rated supply voltage [2)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| Electrical characteristics at 50 Hz and 60 Hz [2)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 39 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,53 | | |

| Colour characteristics (nominal) [2)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| Reference ballast characteristics | | |
|---|---|---|
| Rated frequency | Hz | 50 or 60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,53 |
| Voltage/current ratio | Ω | 350 |
| Power factor | | 0,075±0,005 |

* Lamps are made with various beam angles.

[2)] Values after 100 h ageing. Test position: Vertical cap-up ±5°.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198 [1)] | 305 |
| Inrush current | A | peak | | 10,6 |
| Warm-up current | A | r.m.s. | 0,53 | 1,06 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design [1)]** |
|---|

| **Information for luminaire design** | | | |
|---|---|---|---|
| Maximum permissible temperature (Tp1) at cap rim | °C | Lamp operating temperatures can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply. | |
| Maximum permissible temperature (Tp2) at reflector neck | °C | | |
| Maximum permissible temperature (Tp3) at top of anti-glare screen | °C | | |
| Operating position | | any | |
| Maximum specific effective radiant UV power of the lamp | | $mW/(m^2\ klx)$ | 2 |

[1)] under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| **Superimposed ignition** | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,5 [4] | 5,0 [2] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [3] | |
| Resistance at take-over | | Ω | 4 300 typical | |
| Resistance at run-up | | Ω | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,46 | 0,92 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] 50 to 100, exact value under consideration

[4] under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 4 200 | Reflector R111<br>Self-protected | GX8.5 |

| **Dimensions** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | | |
| D[1)] | | D1[1)] | D2[1)] | | H[1)] | | X[1)] | | L | L1 | L2 |
| Min. | Max. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Max. | Max. | Max. |
| 110,4 | 111 | 103 | 106 | 107,2 | 1,8 | 6 | 5 | 10 | 88 | 70 | 20 |

See sheet 61167-IEC-0215.

[1)] These dimensions are identical to those on sheet 60357-IEC-6450.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 39 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,53 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 or 60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,53 |
| Voltage/current ratio | Ω | 350 |
| Power factor | | 0,075±0,005 |

* Lamps are made with various beam angles.

[1)] Values after 100 h ageing. Test position: Vertical cap-up ±5°.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198 [1)] | 305 |
| Inrush current | A | peak | | 10,6 |
| Warm-up current | A | r.m.s. | 0,53 | 1,06 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design [1)]** |
|---|

| **Information for luminaire design** | | | |
|---|---|---|---|
| Maximum permissible temperature (Tp1) at cap rim | °C | Lamp operating temperatures can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply. | |
| Maximum permissible temperature (Tp2) at reflector neck | °C | | |
| Maximum permissible temperature (Tp3) at top of anti-glare screen | °C | | |
| Operating position | | any | |
| Maximum specific effective radiant UV power of the lamp | | $mW/(m^2\ klx)$ | 2 |

[1)] under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| **Superimposed ignition** | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,5 [4] | 5,0 [2] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [3] | |
| Resistance at take-over | | Ω | 4 300 typical | |
| Resistance at run-up | | Ω | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,46 | 0,92 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] 50 to 100, exact value under consideration

[4] under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 35 W | 3 000 | Reflector MR16<br>Self-protected | GX10 |

| **Dimensions** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | ° |
| A | B | D [1] | | $D_A$ [2] | $D_B$ | N | | V [3] | | α |
| Min. | Max. | Min. | Max. | | Max. | Min. | Max. | Min. | Max. | Max. |
| 0,3 | 4,5 | 49,4 | 50,7 | 48 | 48 | 51 | 54,5 | 1,4 | 4,8 | 60 |

See sheet 61167-IEC-0220.

[1] Allowable maximum diameter includes mould flash and out-of-roundness.

[2] The dimension $D_A$ indicates the inner diameter of the surface Y which has a minimum width of A and can be inclined up to an angle of α.

[3] V is measured at $D_A$.

| **Run-up characteristics at rated supply voltage** [4] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated wattage for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 39 | 85 | 0,46 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [4] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 340 |

* Lamps are made with various beam angles.

[4] Values after 100 h ageing. Test position: Vertical cap-up ±5°.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| **Superimposed ignition** | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,5 [3] | 5,0 [1] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 4 300 typical | |
| Resistance at run-up | | Ω | 30 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,46 | 0,92 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for luminaire design** | | | |
|---|---|---|---|
| Maximum permissible temperature (Tp1) at cap rim | °C | Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply. | |
| Maximum permissible temperature (Tp2) at reflector neck | °C | | |
| Maximum permissible temperature (Tp3) at top of anti-glare screen | °C | | |
| Operating position | | | |
| Maximum specific effective radiant UV power of the lamp | | $mW/(m^2\ klx)$ | 2 |

[1] This limit is for safety reasons.

[2] 50 to 100, exact value under consideration

[3] under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 50 W | 3 000 K | Reflector PAR20<br>Self protected | E27 |

| **Dimensions** (mm) | |
|---|---|
| D (Rated) | L (Maximum) |
| 63,5 | 96 |

See sheet 61167-IEC-0210

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Wattage | W | 53 | | |
| Voltage | V | 87 | 80 | 105 |
| Current | A | 0,76 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 90 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,76 |
| Voltage / current ratio | Ω | 246 |
| Power factor | | 0,075±0,005 |

* Lamps are made with various beam angles.

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 15,2 |
| Warm-up current | A | r.m.s. | 0,76 | 1,52 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible bulb temperature (neck/reflector interface) | °C | 300 |
| Maximum permissible temperature at lens/reflector interface | °C | 160 |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 50 | 85 | 0,59 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 272 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 3 300 typical | |
| Resistance at run-up | | Ω | 22 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,59 | 1,18 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 50 W | 3 000 K | Reflector PAR30<br>Self protected | E27 |

| **Dimensions** (mm) | |
|---|---|
| D (Rated) | L (Maximum) |
| 95 | 125 |

See sheet 61167-IEC-0210

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 53 | | |
| Voltage | V | 87 | 80 | 105 |
| Current | A | 0,76 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 90 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,76 |
| Voltage / current ratio | Ω | 246 |
| Power factor | | 0,075±0,005 |

* Lamps are made with various beam angles.

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 15,2 |
| Warm-up current | A | r.m.s. | 0,76 | 1,52 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible bulb temperature (neck/reflector interface) | °C | 300 |
| Maximum permissible temperature at lens/reflector interface | °C | 160 |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 50 | 85 | 0,59 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 272 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 3 300 typical | |
| Resistance at run-up | | Ω | 22 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,59 | 1,18 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 50 W | 3 000 | Reflector R111<br>Self-protected | GX8.5 |

| **Dimensions** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | | |
| D[1)] | | D1[1)] | D2[1)] | | H[1)] | | X[1)] | | L | L1 | L2 |
| Min. | Max. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Max. | Max. | Max. |
| 110,4 | 111 | 103 | 106 | 107,2 | 1,8 | 6 | 5 | 10 | 88 | 70 | 20 |

See sheet 61167-IEC-0215.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 53 | | |
| Voltage | V | 87 | 80 | 105 |
| Current | A | 0,76 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 90 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,76 |
| Voltage/current ratio | Ω | 246 |
| Power factor | | 0,075±0,005 |

* Lamps are made with various beam angles.

[1)] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 15,2 |
| Warm-up current | A | r.m.s. | 0,76 | 1,52 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible temperature (Tp1) at cap rim | °C | Lamp operating temperatures can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply. |
| Maximum permissible temperature (Tp2) at reflector neck | °C | |
| Maximum permissible temperature (Tp3) at top of anti-glare screen | °C | |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | $mW/(m^2\ klx)$ | 2 |

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 50 | 85 | 0,59 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 272 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [3] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | | [2] | |
| Resistance at take-over | | Ω | 3 300 typical | |
| Resistance at run-up | | Ω | 22 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,59 | 1,18 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] 50 to 100, exact value under consideration

[3] This limit is for safety reasons.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** * | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 50 W | 3 000 | Reflector MR16<br>Self-protected | GX10 |

| **Dimensions** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | ° |
| A | B | D [1] | | $D_A$ [2] | $D_B$ | N | | V [3] | | α |
| Min. | Max. | Min. | Max. | | Max. | Min. | Max. | Min. | Max. | Max. |
| 0,3 | 4,5 | 49,4 | 50,7 | 48 | 48 | 51 | 54,5 | 1,4 | 4,8 | 60 |

See sheet 61167-IEC-0220.

[1] Allowable maximum diameter includes mould flash and out-of-roundness.

[2] The dimension $D_A$ indicates the inner diameter of the surface Y which has a minimum width of A and can be inclined up to an angle of α.

[3] V is measured at $D_A$.

| **Run-up characteristics at rated supply voltage** [4] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [4] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 50 | 85 | 0,59 |
| This lamp is suitable for operation on low frequency square wave ballasts only. Initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Colour characteristics (nominal)** [4] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 90 |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 272 |

* Lamps are made with various beam angles.

[4] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for square wave ballast design** (see Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3 | 5 [5)] |
| Pulse width at 90% peak, option (1) | | µs/s | 100 | |
| Pulse width at 90% peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90% peak, option (2) with 30 s@b | b = | | [6)] | |
| Resistance at take-over | | Ω | 3 300 typical | |
| Resistance at run-up | | Ω | 22 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run-up}$ | | A | 0,59 | 1,18 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for luminaire design** | | | |
|---|---|---|---|
| Maximum permissible lamp temperature adjacent to cap for normal lamp operation | °C | Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply. | |
| Maximum permissible arc tube temperature for normal lamp operation | °C | | |
| Maximum permissible pin temperature for normal lamp operation | °C | | |
| Operating position | | | |
| Maximum specific effective radiant UV power of the lamp | | $mW/(m^2\ klx)$ | 2 |

[5)] This limit is for safety reasons.

[6)] 50 to 100, exact value under consideration.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET *** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap [1] |
|---|---|---|---|
| 70 W | 3 000 | Reflector PAR30<br>Self-protected | E27 |

| **Dimensions** (mm) | |
|---|---|
| D | L |
| Rated | Maximum |
| 95 [2] | 125 |

See sheet 61167-IEC-0210.

| **Run-up characteristics at rated supply voltage** [3] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [3] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 72 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal)** [3] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 82 |

| **Reference ballast characteristics** | | | |
|---|---|---|---|
| Rated frequency | Hz | 50 | 60 |
| Rated voltage | V | 220 | 220 |
| Calibration current | A | 0,98 | 0,98 |
| Voltage/current ratio | Ω | 188 | 188 |
| Power factor | | 0,075±0,005 | 0,075±0,005 |

* Lamps are made with various beam angles.

[1] For cap dimensions see data sheet 7004-21 of IEC 60061-1.

[2] Some manufacturers use reflectors up to 96,8 mm outer diameter.

[3] Values after 100 h ageing. Test position: vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | - | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible bulb temperature (neck/reflector interface) | °C | 300 |
| Maximum permissible temperature at lens/reflector interface | °C | 160 |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power<br>W | Typical voltage<br>V | Typical current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [3] | |
| | Ceramic arc tubes only | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [3] | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | µs/s | [4] | |
| Resistance at take-over | | | Ω | 2 200 typical | |
| Resistance at run-up | | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 0,86 | 1,72 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 10 | 1 000 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET *** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 4 200 K | Reflector PAR30<br>Self-protected | E27 |

| **Dimensions** (mm) | |
|---|---|
| D | L |
| Rated | Maximum |
| 95 [2)] | 125 |

See sheet 61167-IEC-0210.

| **Run-up characteristics at rated supply voltage** [1)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 73 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal)** [1)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 89 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50/60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

* Lamps are made with various beam angles.

1) Values after 100 h ageing. Test position: vertical cap-up ±5°.

2) Some manufacturers use reflectors up to 96,8 mm outer diameter.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible cap temperature | °C | 210 |
| Maximum permissible bulb temperature (neck/reflector interface) | °C | 300 |
| Maximum permissible temperature at lens/reflector interface | °C | 160 |
| Operating position | | any |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 2 |

* under consideration

| | **METAL HALIDE LAMP DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power<br>W | Typical voltage<br>V | Typical current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 5 [2] |
| | Ceramic arc tubes only | | | 3,0 | 5 [2] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 [3] | |
| | Ceramic arc tubes only | | | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 [3] | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | | [4] | |
| Resistance at take-over | | | Ω | 2 200 typical | |
| Resistance at run-up | | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 0,86 | 1,72 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 10 | 1 000 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | | |

[1] Values after 100 h ageing. Test position: vertical cap-up ±5°.

[2] This limit is for safety reasons.

[3] In Japan, 100 µs/s is used for both quartz and ceramic lamps.

[4] 50 to 100, exact value under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET *** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 3 000 | Reflector R111<br>Self-protected | GX8.5 |

| **Dimensions** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | | |
| D[1)] | | D1[1)] | D2[1)] | | H[1)] | | X[1)] | | L | L1 | L2 |
| Min. | Max. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Max. | Max. | Max. |
| 110,4 | 111 | 103 | 106 | 107,2 | 1,8 | 6 | 5 | 10 | 88 | 70 | 20 |

See sheet 61167-IEC-0215.

[1)] These dimensions are identical to those on sheet 60357-IEC-6450.

| **Run-up characteristics at rated supply voltage [1)]** | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz [1)]** | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 75 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal) [1)]** | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 or 60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

* Lamps are made with various beam angles.

[1)] Values after 100 h ageing. Test position: Vertical cap-up ±5°.

| | **METAL HALIDE LAMP DATA SHEET** | Page 2 |
|---|---|---|

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198 * | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | | |
|---|---|---|---|
| Maximum permissible temperature (Tp1) at cap rim | °C | Lamp operating temperatures can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply. | |
| Maximum permissible temperature (Tp2) at reflector neck | °C | | |
| Maximum permissible temperature (Tp3) at top of anti-glare screen | °C | | |
| Operating position | | any | |
| Maximum specific effective radiant UV power of the lamp | | mW/(m$^2$ klx) | 2 |

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power<br>W | Typical voltage<br>V | Typical current<br>A |
| 73 | 85[3] | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** [3] (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,5 [3] | 5,0 [1] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [2] | |
| | | | | |
| Resistance at take-over | | Ω | 2 200 typical | |
| Resistance at run-up | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run\text{-}up}$ | | A | 0,86 | 1,72 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] This limit is for safety reasons.

[2] 50 to 100, exact value under consideration

[3] under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET *** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 4 200 | Reflector R111<br>Self-protected | GX8.5 |

| **Dimensions** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | | |
| D[1)] | | D1[1)] | D2[1)] | | H[1)] | | X[1)] | | L | L1 | L2 |
| Min. | Max. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Max. | Max. | Max. |
| 110,4 | 111 | 103 | 106 | 107,2 | 1,8 | 6 | 5 | 10 | 88 | 70 | 20 |

See sheet 61167-IEC-0215.

[1)] These dimensions are identical to those on sheet 60357-IEC-6450.

| **Run-up characteristics at rated supply voltage [2)]** | | |
|---|---|---|
| Max. time to 90 % lumens | min | 3 |

| **Electrical characteristics at 50 Hz and 60 Hz [2)]** | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 75 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal) [2)]** | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 or 60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

* Lamps are made with various beam angles.

[2)] Values after 100 h ageing. Test position: Vertical cap-up ±5°.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198 * | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | | |
|---|---|---|---|
| Maximum permissible temperature (Tp1) at cap rim | °C | Lamp operating temperatures can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply. | |
| Maximum permissible temperature (Tp2) at reflector neck | °C | | |
| Maximum permissible temperature (Tp3) at top of anti-glare screen | °C | | |
| Operating position | | any | |
| Maximum specific effective radiant UV power of the lamp | | mW/(m$^2$ klx) | 2 |

* under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1] | | |
|---|---|---|
| Rated power<br>W | Typical voltage<br>V | Typical current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast*** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (Annex G) | | | | |
|---|---|---|---|---|
| Superimposed ignition | | | | |
| | | | Min. | Max. |
| Pulse height | | $kV_{peak}$ | 3,5 [4] | 5,0 [2] |
| Pulse width at 90 % peak, option (1) | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | a = | µs/s | 250 | |
| pulse width at 90 % peak, option (2) with 30 s@b | b = | | [3] | |
| | | | | |
| Resistance at take-over | | Ω | 2 200 typical | |
| Resistance at run-up | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | |
| Run-up current: $I_{run\text{-}up}$ | | A | 0,86 | 1,72 |
| | | | | |
| Steady state operation | | | | |
| High frequency ripple limitation range | | kHz | 10 | 1 000 |
| | | | | |
| Performance limits of rated power for extended operation | | | | |
| 120 V to 135 V lamp voltage | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life which can lead to ballast overheating, suitably protected circuits shall be used for the operation of this lamp. | | | | |

[1] Values after 100 h ageing. Test position: vertical cap up ±5°.

[2] This limit is for safety reasons.

[3] 50 to 100, exact value under consideration

[4] under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 3 000 K | Double-capped | RX7s |

| **Dimensions** (mm) | | | | |
|---|---|---|---|---|
| A (max.) | B (max.) | Z | C | D |
| 22 | 117,6 | 114,2±1,6 | 57 | 7 |

See sheet 61167-IEC-0110.

| **Run-up characteristics at rated supply voltage** [1) 2)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 4 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1) 2)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 75 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal)** [1) 2)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 or 60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

1) Values after 100 h ageing. Test position: horizontal ±5°.

2) Values in luminaire simulator, see Clause B.2.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 280* |
| Maximum permissible outer bulb temperature | °C | [3)] |
| Operating position | | Horizontal ±45° |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 6 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[3)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | **METAL HALIDE LAMP DATA SHEET** | Page 3 |
|---|---|---|

ILCOS: MD-70/30/1B-H-RX7s-22/117,6

| **Electrical characteristics under square wave conditions in steady state operation** [1) 2)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 3) |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3,0 | 3) |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 4) | |
| | Ceramic arc tubes only | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 4) | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | µs/s | 5) | |
| Resistance at take-over | | | Ω | 2 200 typical | |
| Resistance at run-up | | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 0,86 | 1,72 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 10 | 1 000 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | | |

1) Values after 100 h ageing. Test position: horizontal ±5°.

2) Values in luminaire simulator, see Clause B.2.

3) This limit is for safety reasons and under consideration.

4) In Japan, 100 µs/s is used for both quartz and ceramic lamps.

5) 50 to 100, exact value under consideration

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |
|---|---|---|

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 70 W | 4 200 K | Double-capped | RX7s |

| **Dimensions** (mm) | | | | |
|---|---|---|---|---|
| A (max.) | B (max.) | Z | C (nominal) | D (nominal) |
| 22 | 117,6 | 114,2±1,6 | 57 | 7 |

See sheet 61167-IEC-0110.

| **Run-up characteristics at rated supply voltage** [1) 2)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 4 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1) 2)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 75 | | |
| Voltage | V | 90 | 80 | 105 |
| Current | A | 0,98 | | |

| **Colour characteristics (nominal)** [1) 2)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | |
|---|---|---|
| Rated frequency | Hz | 50 or 60 |
| Rated voltage | V | 220 |
| Calibration current | A | 0,98 |
| Voltage/current ratio | Ω | 188 |
| Power factor | | 0,075±0,005 |

1) Values after 100 h ageing. Test position: horizontal ±5°.

2) Values in luminaire simulator, see Clause B.2.

| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |
|---|---|---|

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 19,6 |
| Warm-up current | A | r.m.s. | 0,98 | 1,96 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 280* |
| Maximum permissible outer bulb temperature | °C | [3)] |
| Operating position | | Horizontal ±45° |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 6 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[3)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP DATA SHEET** | Page 3 |

| **Electrical characteristics under square wave conditions in steady state operation** [1) 2)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 73 | 85 | 0,86 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 170 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | [3)] |
| | Ceramic arc tubes only | | | 3,0 | [3)] |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | μs/s | 250 [4)] | |
| | Ceramic arc tubes only | | | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | μs/s | 250 [4)] | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | | [5)] | |
| Resistance at take-over | | | Ω | 2 200 typical | |
| Resistance at run-up | | | Ω | 16 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 0,86 | 1,72 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 10 | 1 000 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | | |

1) Values after 100 h ageing. Test position: horizontal ±5°.

2) Values in luminaire simulator, see Clause B.2.

3) This limit is for safety reasons and under consideration.

4) In Japan, 100 μs/s is used for both quartz and ceramic lamps.

5) 50 to 100, exact value under consideration.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 150 W | 3 000 K | Double-capped | RX7s-24 |

| **Dimensions** (mm) | | | | |
|---|---|---|---|---|
| A (max.) | B (max.) | Z | C | D |
| 25 | 135,4 | 132±1,6 | 66 | 18 |

See sheet 61167-IEC-0110.

| **Run-up characteristics at rated supply voltage** [1) 2)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 4 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1) 2)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 150 | | |
| Voltage | V | 95 | 80 | 110 |
| Current | A | 1,8 | | |

| **Colour characteristics (nominal)** [1) 2)] | | |
|---|---|---|
| Correlated colour temperature | K | 3 000 |
| Chromaticity co-ordinate x | | 0,434 |
| Chromaticity co-ordinate y | | 0,398 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | | |
|---|---|---|---|
| Rated frequency | Hz | 50 | 60 |
| Rated voltage | V | 220 | 220 |
| Calibration current | A | 1,8 | 1,8 |
| Voltage/current ratio | Ω | 99 | 97 |
| Power factor | | 0,060±0,005 | 0,075±0,005 |

1) Values after 100 h ageing. Test position: horizontal ±5°.

2) Values in luminaire simulator, see Clause B.2.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 36,0 |
| Warm-up current | A | r.m.s. | 1,8 | 3,2 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 280* |
| Maximum permissible outer bulb temperature | °C | [1)] |
| Operating position | | Horizontal ±45° |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 6 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[1)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

| | **METAL HALIDE LAMP DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1) 2)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 147 | 90 | 1,63 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 97 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 3) |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3,0 | 3) |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | µs/s | 250 4) | |
| | Ceramic arc tubes only | | µs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | µs/s | 250 4) | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | µs/s | 5) | |
| Resistance at take-over | | | Ω | 1 100 typical | |
| Resistance at run-up | | | Ω | 8,2 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 1,63 | 3,27 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 8 | 400 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | | |

1) Values after 100 h ageing. Test position: horizontal ±5°.

2) Values in luminaire simulator, see Clause B.2.

3) This limit is for safety reasons and under consideration.

4) In Japan, 100 µs/s is used for both quartz and ceramic lamps.

5) 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 150 W | 4 200 K | Double-capped | RX7s-24 |

| **Dimensions** (mm) | | | | |
|---|---|---|---|---|
| A (max.) | B (max.) | Z | C | D |
| 25 | 135,4 | 132±1,6 | 66 | 18 |

See sheet 61167-IEC-0110.

| **Run-up characteristics at rated supply voltage** [1) 2)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 4 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1) 2)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 150 | | |
| Voltage | V | 95 | 80 | 110 |
| Current | A | 1,8 | | |

| **Colour characteristics (nominal)** [1) 2)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | | |
|---|---|---|---|
| Rated frequency | Hz | 50 | 60 |
| Rated voltage | V | 220 | 220 |
| Calibration current | A | 1,8 | 1,8 |
| Voltage/current ratio | Ω | 99 | 97 |
| Power factor | | 0,060±0,005 | 0,075±0,005 |

1) Values after 100 h ageing. Test position: horizontal ±5°.

2) Values in luminaire simulator, see Clause B.2.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 36,0 |
| Warm-up current | A | r.m.s. | 1,8 | 3,2 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 280* |
| Maximum permissible outer bulb temperature | °C | [3)] |
| Operating position | | Horizontal ±45° |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 6 |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

* under consideration

[3)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

| | **METAL HALIDE LAMP DATA SHEET** | Page 3 |
|---|---|---|

| **Electrical characteristics under square wave conditions in steady state operation** [1) 2)] | | |
|---|---|---|
| Rated power for ballast design<br>W | Typical lamp voltage<br>V | Typical lamp current<br>A |
| 147 | 90 | 1,63 |
| For lamps declared by manufacturers as suitable for use on LFSW ballasts only, initial lamp voltages shall be in the range of 75 V to 110 V. Manufacturers may have different target values for lamp voltage and the current will vary accordingly. | | |

| **Information for reference ballast** (see Annex E) | | |
|---|---|---|
| Series resistor of the low frequency square wave reference ballast | Ω | 97 |

| **Information for square wave ballast design** (see Annex G) | | | | | |
|---|---|---|---|---|---|
| Superimposed ignition | | | | | |
| | | | | Min. | Max. |
| Pulse height | Ceramic and quartz arc tubes | | $kV_{peak}$ | 3,5 | 3) |
| | Ceramic arc tubes only | | $kV_{peak}$ | 3,0 | 3) |
| Pulse width at 90 % peak, option (1) | Ceramic and quartz arc tubes | | μs/s | 250 4) | |
| | Ceramic arc tubes only | | μs/s | 100 | |
| Pulse width at 90 % peak, option (2) with 3 s@a, combined with | Ceramic and quartz arc tubes | a = | μs/s | 250 4) | |
| pulse width at 90 % peak, option (2) with 30 s@b | | b = | μs/s | 5) | |
| Resistance at take-over | | | Ω | 1 100 typical | |
| Resistance at run-up | | | Ω | 8,2 typical | |
| The resistors for take-over and run-up are part of the set-up in order to measure the current. | | | | | |
| Run-up current: $I_{run-up}$ | | | A | 1,63 | 3,27 |
| | | | | | |
| Steady state operation | | | | | |
| High frequency ripple limitation range | | | kHz | 8 | 400 |
| | | | | | |
| Performance limits of rated power for extended operation | | | | | |
| 120 V to 135 V lamp voltage | | | % | 80 | 110 |
| >135 V to 150 V lamp voltage | | | % | 0 | 110 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | | |

1) Values after 100 h ageing. Test position: horizontal ±5°.

2) Values in luminaire simulator, see Clause B.2.

3) This limit is for safety reasons and under consideration.

4) In Japan, 100 μs/s is used for both quartz and ceramic lamps.

5) 50 to 100, exact value under consideration

| | | |
|---|---|---|
| | **METAL HALIDE LAMP**<br>**DATA SHEET** | Page 1 |

| Nominal power | Correlated colour temperature (nominal) | Version | Cap |
|---|---|---|---|
| 250 W | 4 200 K | Double-capped | Fc2 |

| **Dimensions** (mm) | | | |
|---|---|---|---|
| A (max.) | Z | C (nominal) | D (nominal) |
| 27,5 | 139 +0/-1 | 69,5 | 27 |

See sheet 61167-IEC-0120.

| **Run-up characteristics at rated supply voltage** [1) 2)] | | |
|---|---|---|
| Max. time to 90 % lumens | min | 6 |

| **Electrical characteristics at 50 Hz and 60 Hz** [1) 2)] | | | | |
|---|---|---|---|---|
| | | Rated | Minimum | Maximum |
| Power | W | 250 | | |
| Voltage | V | 100 | 90 | 110 |
| Current | A | 3,0 | | |

| **Colour characteristics (nominal)** [1) 2)] | | |
|---|---|---|
| Correlated colour temperature | K | 4 200 |
| Chromaticity co-ordinate x | | 0,371 |
| Chromaticity co-ordinate y | | 0,366 |
| Colour rendering index Ra | | 80 |

| **Reference ballast characteristics** | | | |
|---|---|---|---|
| Rated frequency | Hz | 50 | 60 |
| Rated voltage | V | 220 | 220 |
| Calibration current | A | 3,0 | 3,0 |
| Voltage/current ratio | Ω | 60 | 59 |
| Power factor | | 0,060±0,005 | 0,075±0,005 |

1) Values after 100 h ageing. Test position: horizontal ±5°.

2) Values in luminaire simulator, see Clause B.2.

| | | |
|---|---|---|
| | **METAL HALIDE LAMP DATA SHEET** | Page 2 |

| **Information for electromagnetic ballast design** | | | | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Open circuit voltage for starting | V | r.m.s. | 198 | |
| Sustaining voltage for stable operation | V | r.m.s. | 198* | 305 |
| Inrush current | A | peak | | 60,0 |
| Warm-up current | A | r.m.s. | 3,0 | 5,2 |
| Because of a possible risk that abnormal operating conditions may occur at the end of lamp life, which can lead to ballast overloading, suitably protected circuits shall be used for operation of this lamp. | | | | |

| **Information for ignitor design*** |
|---|

| **Information for luminaire design** | | |
|---|---|---|
| Maximum permissible pinch temperature | °C | 300* |
| Maximum permissible outer bulb temperature | °C | [3)] |
| Operating position | ° | Horizontal ±45 |
| Maximum specific effective radiant UV power of the lamp | mW/klm | 6* |
| The luminaire shall be provided with a protective shield. For requirements, see IEC 60598-1. | | |

[3)] Lamp operating temperatures and burning position can affect performance. Due to different designs from different manufacturers, temperature limits will differ. Limits from the relevant manufacturer's data sheets apply.

* under consideration

### 6.3 List of maximum lamp outline sheets (*construction according to IEC 61126*)

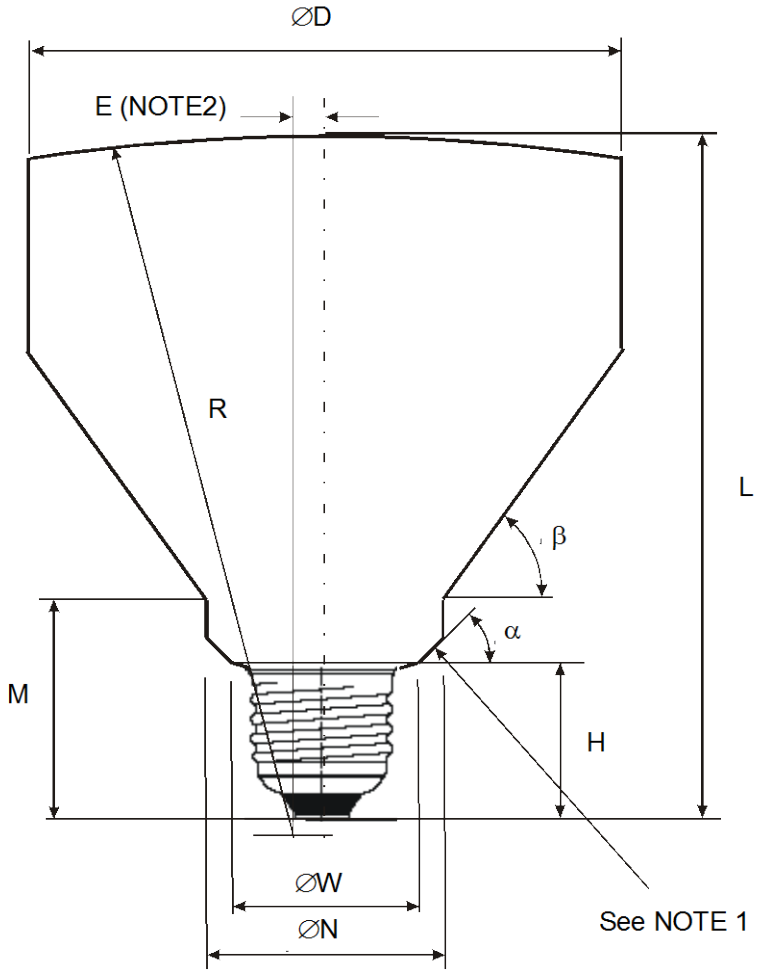
Table 3 represents the listing of the maximum lamp outline sheets.

**Table 3 – List of maximum lamp outline sheets**

| Sheet number | Bulb, reflector, arc | Lamp type; cap |
|---|---|---|
| - | tubular | GU6.5 |
| | tubular | G8.5 |
| | tubular | GU8.5 |
| - | radial, vertical | G12 |
| | tubular | E27, E40 |
| | elliptical | E27, E40 |
| 4 400 | PAR20, PAR30 | E27 |
| | R111 | GX8.5 |
| 4 500 | MR16 | GX10 |
| - | tubular | RX7s, RX7s-24 |
| - | tubular | Fc2 |

# METAL HALIDE LAMP
# MAXIMUM LAMP OUTLINE SHEET
# E27 capped reflector lamp

Page 1




| Parameter | Dimension | PAR20 | PAR30 |
|---|---|---|---|
| øD | mm | 73,0 | 108,0 |
| E (NOTE 2) | mm | 5,5…6,0 | 5,5…6,0 |
| H | mm | 28,3 | 28,3 |
| M | mm | 32,0 | 40,0 |
| L | mm | 96,0 | 125,0 |
| øN | mm | 37,0 | 43,0 |
| øW | mm | 34,0 | 34,0 |
| α | ° | 45 | 45 |
| β | ° | 52 | 54 |

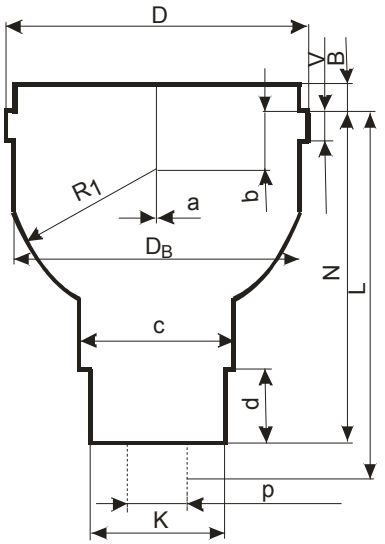
NOTE 1 Below this line, the gauge 7006-50 for finished lamps applies.

NOTE 2 An angular displacement of 3° has been taken into account in constructing the maximum lamp outline.

# METAL HALIDE LAMP
# MAXIMUM LAMP OUTLINE SHEET
# GX10 capped reflector lamp

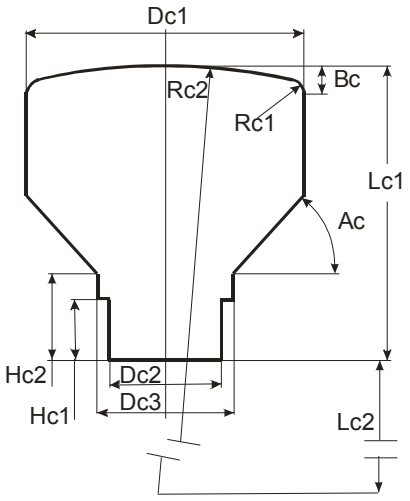
Page 1

NOTE These lamps are intended for use in applications where the lamp can be fixed either by the rim or by the cap. There are accordingly two lamp maximum outline drawings based on the manner of fixation.




| | | | |
|---|---|---|---|
| Maximum overall length | L | mm | 60,9 |
| Maximum reflector length | N | mm | 54,5 |
| Maximum flange thickness | V | mm | 4,8 |
| Free space dimension | K | mm | 22,6 |
| Maximum outside diameter | D | mm | 50,7 |
| Maximum outside diameter | $D_B$ | mm | 48 |
| Horizontal centrepoint of R | a | mm | - |
| Vertical centrepoint of R | b | mm | 9,5 |
| Radius | $R_1$ | mm | 25 |
| Normal contact pin spacing | p | mm | 10 |
| Maximum cover height | B | mm | 4,5 |
| - | c | mm | 26 |
| - | d | mm | 12 |

**(a) Maximum lamp outlines based on rim fixation**




| | | | |
|---|---|---|---|
| Maximum overall length | Lc1 | mm | 59 |
| | Lc2 | mm | 51 |
| | Bc | mm | 5,7 |
| Minimum overall length | | mm | 51 |
| | Ac | ° | 48 |
| Maximum diameter | Dc1 | mm | 55,7 |
| Free space dimension | Dc2 | mm | 22,6 |
| | Dc3 | mm | 27,4 |
| | Hc1 | mm | 12 |
| | Hc2 | mm | 17,3 |
| Radius | Rc1 | mm | 3 |
| Radius | Rc2 | mm | 120 |

**(b) Maximum lamp outlines based on cap fixation**

# Annex A
(normative)

# Method of measuring lamp starting and warm-up characteristics

## A.1 General

Lamps shall not be operated during 5 h immediately prior to making these tests.

Lamps shall be tested in a circuit as shown in Figure A.1, at an ambient temperature between 20 °C and 30 °C, using a nominal 50 Hz or 60 Hz supply as appropriate, and a reference ballast.

The reference ballast used in conventional electromagnetic operation shall be of inductive type. It shall satisfy the requirements of IEC 60923.

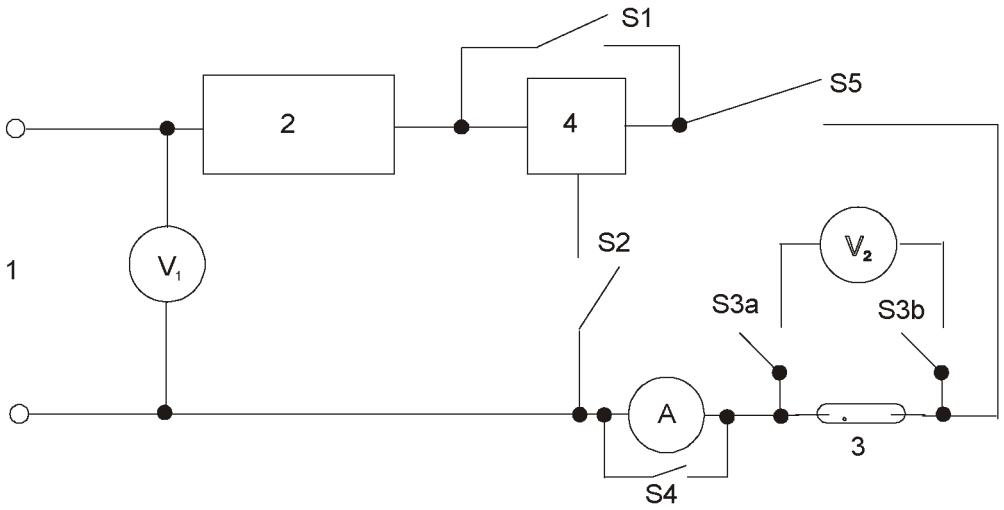
Single-capped lamps shall operate in a vertical cap-up position unless otherwise specified by the manufacturer. Double-capped lamps shall operate in a horizontal position unless otherwise specified on the lamp datasheet. The luminous flux during run-up is measured as detailed in Clause B.2.

## A.2 Measurements

The ammeter shall be short-circuited by closing switch $S_4$, and the voltmeter $V_2$ shall be open-circuited by opening switch $S_3$. Switches $S_1$ and $S_5$ shall be open, switch $S_2$ closed. The voltage measured by voltmeter $V_1$ shall be set to the starting voltage given on the relevant lamp data sheet. If this standard does not provide a lamp starting voltage, the lamp manufacturer should be asked the same.

Starting is initiated by closing switch $S_5$. Immediately after starting, switch $S_2$ and $S_4$ shall be opened and switch $S_1$ and $S_3$ shall be closed.

For the purpose of evaluating the ballast, the warm-up current and the run-up time are measured.




**Key**

1 Supply; sine wave

2 Reference ballast

3 Lamp

4 Ignitor

**Figure A.1 – Circuit diagram for measurement of lamp starting and warm-up characteristics**

Other methods of ignition circuit are possible, care should be taken that the ignition circuit does not influence the measurement.

# Annex B
(normative)

# Method of measuring electrical and photometrical characteristics (lamps for operation on 50 Hz or 60 Hz supply frequencies)

## B.1 General

Lamps shall be tested in a circuit as shown in Figure B.1, at an ambient temperature of between 20 °C and 30 °C, using a nominal 50 Hz or 60 Hz supply as appropriate.

With the exception of double-capped lamps, for the tests, the lamps shall be operated in free air or as specified on the relevant lamp data sheet.

Ballasts used for these measurements shall be reference ballasts having a voltage-to-current ratio and power factor as specified on the relevant lamp data sheets and meeting the general requirements for reference ballasts given in IEC 60923.

Before initial readings are taken, the lamp shall be aged for 100 h on a ballast that satisfies the requirements of IEC 60923, at the rated voltage and frequency of the ballast. The supply voltage shall not vary by more than ±3 % and the frequency by not more than ±1 Hz.

The allowed tolerances are chosen to avoid the necessity of having a stabilised voltage and to permit the use of a normal mains supply.

NOTE North American practice allows for measurement at both rated input voltage and at rated lamp power. In case of rated lamp power measurement, the supply voltage provided to the reference ballast should be adjustable.

For operating position, see Clause A.1.

〖C〗 Photometric characteristics shall be measured in accordance with EN 13032-1. For determination of the centre beam intensity of reflector lamps, EN 61341 shall be used. 〖C〗

UV spectra for evaluation of the actinic UV hazard are taken according to IEC 62471 from 200 nm up to 400 nm.

Care for personal protection should be taken when taking UV measurements.

## B.2 Particular requirements for double-capped lamps

Due to their temperature-related behaviour, double-capped lamps should always be operated in luminaires. Therefore, for measurement of the electrical, photometrical and colour characteristics, lamps shall be operated within a luminaire simulator. Correction has to be made for changes in the luminous flux and – if applicable – for changes of the UV characteristics due to the use of the luminaire simulator. The correction factor is 1,05 to be applied to the luminous flux and UV value, both achieved with the lamp operated in the luminaire simulator.

For UV measurements, the simulator consists of an undoped quartz tube which is closed at both ends by an aluminium disk with matt surfaces (see Figure B.2). For other photometric measurements, the simulator tube wall consists of undoped quartz or hard glass.

The position of the lamp during measurement shall be horizontal. For lamps with exhaust tip, provisions shall be taken to ensure that the exhaust tip of the discharge tube is directed upwards; the angle is under consideration.

## B.3 Colour characteristics

This clause covers nominal values for the correlated colour temperature and the chromaticity co-ordinates *x* and *y*. A compilation is given in Table B.1.

**Table B.1 – Correlated colour temperature and chromaticity co-ordinates *x* and *y***

| Correlated colour temperature<br>K | *x* | *y* |
|---|---|---|
| 3 000 | 0,434 | 0,398 |
| 4 200 | 0,371 | 0,366 |

## B.4 Supply

The supply voltage and frequency shall be equal to the rated values of the reference ballast, with a tolerance of ±0,5 %.

The wave shape of the supply voltage shall be a sine wave when using electromagnetic ballasts. The total harmonic content shall not exceed 3 % of the fundamental. The total harmonic content is defined as the root-mean-square (r.m.s.) summation of the individual harmonic components, using the fundamental as 100 %.

This implies that the source of supply should have sufficient power and that the supply circuit should have a sufficiently low impedance compared with the ballast impedance, and care should be taken that this applies under all conditions that occur during the measurement.

When measurements are to be made at rated lamp power, the input voltage is adjusted until the lamp power is within 1 % of rated power during stable operation.

During the period of stabilisation, the supply voltage and frequency shall be stable within ±0,5 %, this tolerance being reduced to ±0,2 % at the moment of measurement.

## B.5 Instruments

Instruments shall be of the true r.m.s. type, essentially free from waveform errors and of a precision appropriate to the requirements.

Voltage measuring circuits of instruments connected across a lamp shall take not more than 0,5 % of the rated lamp current.

Instruments connected in series with the lamp shall have sufficiently low impedance such that the voltage drop shall not exceed 1 % of the rated lamp voltage.

## B.6 Measurement

When measuring lamp voltage, the wattmeter voltage measuring circuit shall be open and the wattmeter current measuring circuit shall be short-circuited, if necessary.

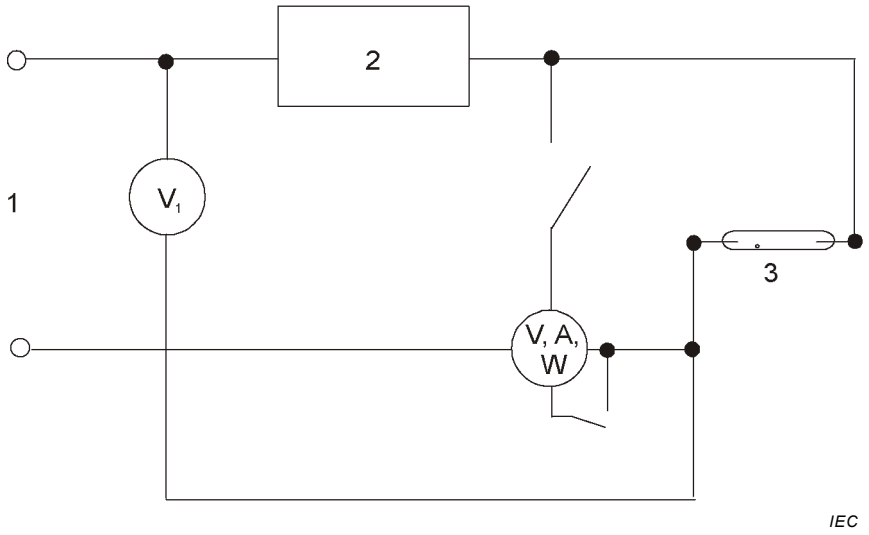
When measuring the lamp power, the lamp voltmeter circuit shall be open and the ammeter shall be short-circuited, if necessary. No correction shall be made for the power consumed by the wattmeter as the circuit connection is made on the lamp side of the current measuring circuit.

NOTE The reference above to the absence of a correction of the consumption of the voltage circuit of the wattmeter arises from an empirical observation which shows that in most cases, at the same supply voltage, the said consumption compensates approximately for the reduction of the power consumption of the lamp caused by the parallel connection of the voltage circuit of the wattmeter.

In case of doubt, it is possible to evaluate the compensation error by repeating the measurements with other values of the load in parallel with the lamp.

This is done by adding resistances in parallel with the lamp and by reading each time the power measured by the wattmeter. It is the possible to extrapolate the results obtained in order to determine the true power in the absence of any parallel load.

The lamp shall be operated until the electrical characteristics are stable before any readings on the lamp are taken.



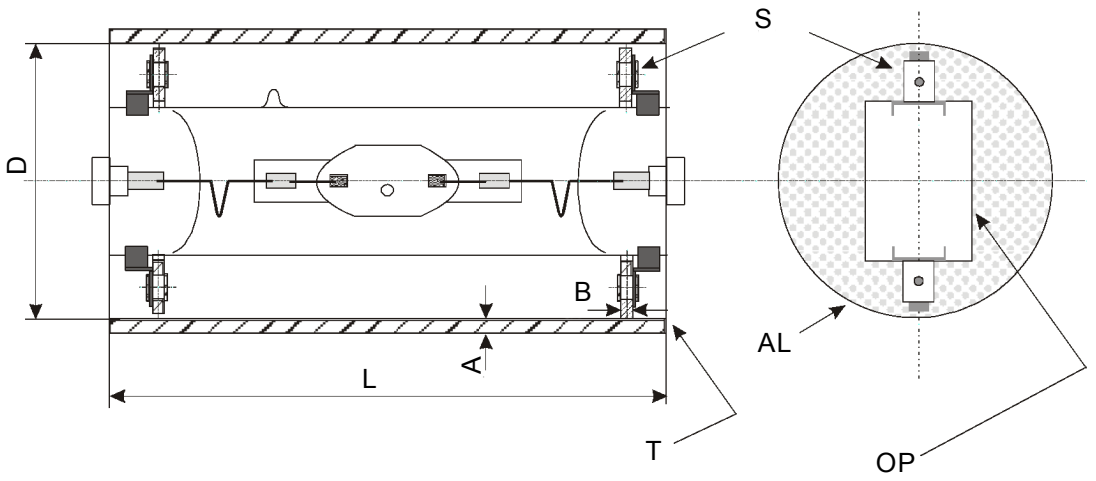

**Key**

1 supply

2 reference ballast

3 lamp

**Figure B.1 – Circuit diagram for measurement of lamp characteristics**




**Key**

T tube of undoped quartz or hard glass (for UV measurements only undoped quartz)

D inner tube diameter: 50 mm to 51,5 mm

L length of tube: 100 mm for 70 W lamp, 120 mm for 150 W lamp and 140 mm ±1 mm for 250 W lamp

A thickness of tube wall: 2,5 mm to 3,5 mm

AL aluminium disk

B thickness of the aluminium disk: 2 mm

OP opening to suit lamp pinch

S suspension for the lamp with a spring or bracket to hold the pinch

Size the diameter of the aluminium disk to fit inside the simulator tube allowing for expansion.

**Figure B.2 – Luminaire simulator for use with double-capped lamps**

# Annex C
(normative)

# Method of test for lumen maintenance and life

## C.1 General

The luminous flux and (for reflector lamps) the centre beam intensity at a given time in the life of a lamp shall be measured as specified in Annex B.

During the life testing, lamps shall be operated as follows.

Lamps shall be operated at an ambient temperature such that the limits of temperature for pinch and outer bulb which are given on the lamp data sheets are not exceeded. The lamps shall not be subjected to extreme vibration and shock.

Lamps shall be operated in the test position as specified on the relevant lamp data sheet or by the lamp manufacturer.

The connections of the lamp contacts, with reference to the terminations of the ballast, shall not be changed for the whole course of the tests.

Lamps shall be switched off for 1 h after each 11 h of operation.

## C.2 Lamps for operation on 50 Hz or 60 Hz supply frequencies

The ballast used shall comply with the requirements of IEC 60923.

The choice of the type of ballasts for the tests is left open, but the type used may have an influence on the results of the test. It is recommended that the type of ballast employed should be stated. In case of doubt, the use of an inductive type of ballast is recommended, because such a type has the smallest number of parameters capable of affecting the results.

The type of ignitor to be used shall comply with the requirements of IEC 60927, and shall, in any case, be subject to agreement with the lamp manufacturer or responsible vendor.

The choice of the type (superimposed, semi-parallel,…) and brand of the ignitor for the tests is left open, but the type used may have an influence on the results of the test. It is recommended that the type and brand of the ignitor employed should be stated.

During the life testing, the supply voltage and frequency shall not differ by more than 3 % from the rated voltage and frequency accordingly, of the ballast used.

## C.3 Lamps for operation on low frequency square wave

The ballast used shall comply with the requirements of the “information for square wave ballast design” on the relevant lamp data sheet.

During the life testing, the supply voltage and frequency shall be within the range for which the characteristics specified in Annex G are maintained.

The choice of the type of ballasts for the tests is left open, but the type used may have an influence on the results of the test. It is recommended that the type of ballast employed should be stated.

# Annex D
(informative)

# Information for luminaire design

## D.1 Maximum lamp outlines

Maximum lamp outlines, given in 6.3 and constructed according to IEC 61126, are provided for the guidance of designers of luminaires and are based on a maximum sized lamp inclusive of outer bulb to cap displacement.

For mechanical acceptance of lamps complying with this standard, a free space should be provided in the luminaire based on these maximum outlines.

## D.2 Replacement of lamps

Luminaire design should ensure correct lamp replacement, also with respect to UV emission.

NOTE Examples of lamps with threshold UV values of 6 mW/klm are given on the datasheets 1156 and 3250.

# Annex E
(normative)

# Method of measuring electrical and photometrical characteristics on low frequency square wave reference ballast

## E.1 Purpose of this annex

This annex is applicable to reference measurement of lamps.

Lamps shall be tested at an ambient temperature of between 20 °C and 30 °C.

For operating position, see Clause A.1. For particular requirements for double-capped lamps, see Clause B.2. For colour characteristics, see Clause B.3.

〈C〉 Photometric characteristics shall be measured in accordance with EN 13032-1. For determination of the centre beam intensity of reflector lamps, EN 61341 shall be used. 〈C〉

UV spectra for evaluation of the actinic UV hazard are taken according to IEC 62471 from 200 nm up to 400 nm.

Care for personal protection should be taken when taking UV measurements.

## E.2 Characteristics

Table E.1 provides for the setting of the reference ballast, valid for all lamps which are operated with low frequency square wave.

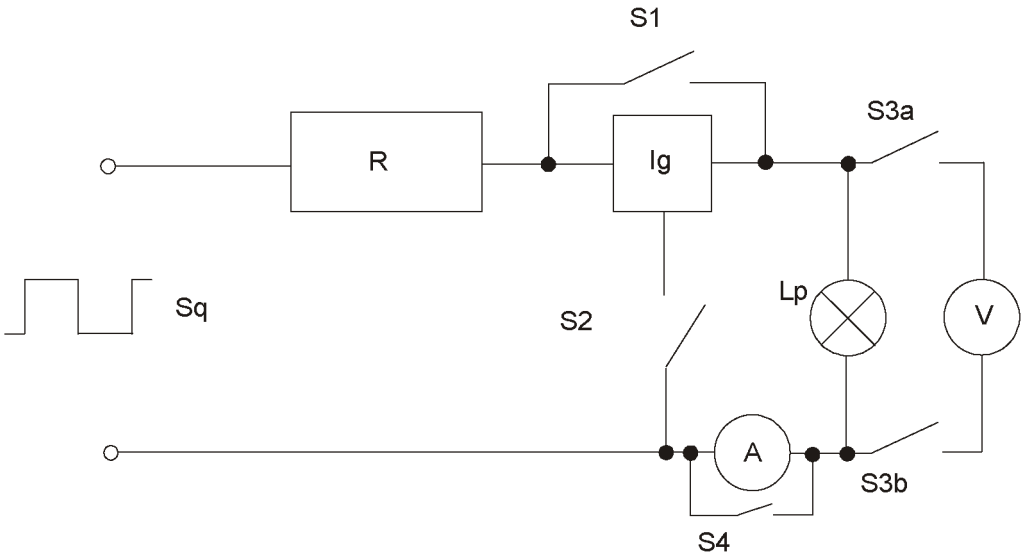
**Table E.1 – Characteristics of the reference ballast**

| | | |
|---|---|---|
| **Rated frequency (square wave)** | Hz | 150 ± 30 |
| **Applied voltage (r.m.s.)** | V | To be adjusted to reach rated lamp power |
| **Fall time** | μs | < 100 |
| **Rise time** | μs | < 100 |
| **Duty cycle** | % | 50±1 |
| **Voltage overshoot** | % | < 5 |
| **Voltage overshoot time** | μs | ≤ 50 |
| **Power factor** | | > 0,998 |

## E.3 Test procedure

### E.3.1 General

Figure E.1 schematically shows the circuit for lamp measurement under reference conditions.




**Key**

Sq square wave supply

Lp lamp

R reference ballast (resistor)

Ig ignitor

**Figure E.1 – Circuit for lamp measurement under reference conditions**

### E.3.2 Start-up

The lamp is placed into the circuit. Switches S1, S3a and S3b are open. Switches S2 and S4 are closed. The square wave supply is set to 280 V and then the circuit is energised. The lamp is allowed to run-up for 5 min.

### E.3.3 Steady state

Switches S1, S3a and S3b are closed. Switches S2 and S4 are opened. The supply voltage is adjusted until the rated lamp power is reached. The lamp is let for stabilising for 15 min to 20 min. The lamp characteristics are measured. The square wave supply is switched off. The lamp is removed after cooling.

# Annex F
(normative)

# Spectral analysis of power ripple: calculation procedure for amplitude spectrum ratio and guidance

## F.1 General

This annex is applicable to measurements of the power ripple of lamps.

## F.2 Mathematical background

### F.2.1 General

In this subclause, the algorithm is described which is used to calculate the spectral power ratio (SPR) of lamps. The measurement procedure stated in Clause F.3 is based on this algorithm and uses specific settings (listed under Clause F.3).

### F.2.2 Description of the algorithm

Suppose that the instantaneous power signal is represented by a time sequence

$$x(k), \quad k = 0 \ldots N-1,$$

where $N$ is its length. $N$ can be expressed as $N = T_{\text{rec}} \cdot F_{\text{s}}$ with $T_{\text{rec}}$ being the whole time interval of the power signal and $F_{\text{s}}$ being the sampling frequency. The sequence is divided into $K$ segments of length $T_{\text{seg}} = 1\ \text{ms}$, which are $L = T_{\text{seg}} \cdot F_s$ points each. A Blackman window function $w(k+1) = 0{,}42 - 0{,}5\cos(2\pi k/(L-1)) + 0{,}08\cos(4\pi k/(L-1))$, $k = 0, 1, \ldots, L-1$ is applied to each segment. The segments shall have 50 % overlap ($M = 0{,}5 \cdot T_{\text{seg}} \cdot F_s$ points). The number of segments can be found as

$$K = \frac{N-M}{L-M} \tag{F.1}$$

The segments partitioned from the entire $N$ data points are represented by sequences

$$x_m(k) = x(k + (m-1)(L-M)) \tag{F.2}$$

for $k = 0, 1, \ldots, L-1$ and $m = 1, \ldots, K$. The averaged amplitude spectrum can be written as

$$\overline{S}_x(n) = \frac{1}{K} \sum_{m=1}^{K} \left| \sum_{k=0}^{L-1} w(k) x(k + (m-1)(L-M)) e^{-jn\frac{2\pi k}{L}} \right| \tag{F.3}$$

for $n = 0, 1, \ldots, L-1$. The outer summation in Equation (F.3) represents averaging operation over the segments, and its argument is the discrete Fourier transform of a segment. The averaged amplitude spectrum, Equation (F.3) can be computed as

$$\overline{S}_x(n) = \frac{1}{K}\sum_{m=1}^{K}\left|\mathrm{FFT}(X_w(m))\right| \tag{F.4}$$

for $n = 0, 1, \ldots, L-1$ and with the vector $X_w(m)$ obtained using Equation (F.2) as

$$X_w(m) = \left[w(0)x_m(0) \quad w(1)x_m(1) \quad \ldots \quad w(L-1)x_m(L-1)\right].$$

The result in Equation (F.4) is a so-called two-sided amplitude spectrum. The averaged amplitude spectrum ratio with respect to the DC component $\overline{S}_x(0)$ is a sequence

$$\left\{1 \quad \frac{\overline{S}_x(1)}{\overline{S}_x(0)} \quad \ldots \quad \frac{\overline{S}_x(n)}{\overline{S}_x(0)}\right\} \tag{F.5}$$

with the corresponding frequency vector $f_x = \left[0 \quad 1 \quad \ldots \quad n\right] \cdot F_s/L$ till $n = (L/2) - 1$. Note that the window function $w(k)$ does not have to be normalized to obtain Equation (F.5).

## F.3 Measurement procedure

The electronic gear is connected to the mains voltage supply. The output terminals are connected to the intended lamp.

Procedure and settings:

The mains voltage is switched on and the ballast is let for stabilising during 15 min.

A digital oscilloscope is used to measure the current and voltage. The oscilloscope shall be able to sample two channels simultaneously with at least 200 000 points at a sampling frequency of 2 MHz. After 15 min, the current and voltage waveforms are recorded with the scope using the settings listed in Table F.1 below. The signals shall be acquired on a full vertical scale with at least 8 bit resolution. The sampled current and voltage values are multiplied point by point to get the power signal, which is then analysed with the algorithm described under Clause F.2, using the parametric values given in Table F.1.

**Table F.1 – Settings of the analysing oscilloscope**

| | |
|---|---|
| Sampling frequency ($F_s$) minimum | 2 MHz (Sampling time $T_s$ = 0,5 μs) |
| Total recorded time ($T_{rec}$) minimum | 100 ms ($N$ = 200 000 samples) |
| Window time ($T_{seg}$) | 1 ms (2 000 samples) |
| Window overlap time ($T_{over}$) | 0,5 ms (1 000 samples) |
| Window function ($w$(k)) | Blackman window |

## F.4 Test signal

### F.4.1 General

In order to test different implementations of the SPR measurement method in Clause F.3, a test signal (a current and a voltage waveform) will be described. The settings of the analysing oscilloscope as in Clause F.3 are used.

### F.4.2 Description of the test signal

The voltage form is constructed as follows:

An ideal square wave voltage of 100 V r.m.s. and a frequency of 100 Hz is sampled at a sampling rate of 2 MHz. The sampling starts at the rising edge of the square wave. A sine voltage wave is superimposed on this square wave. The sine wave has an amplitude of 1 V and a frequency of 50 kHz, representing a 1 % voltage ripple where

$$V_{\text{square}}[k] = (-1)^{x} \cdot 100 \text{ with } x = \begin{cases} 2 \text{ if } k = (l + 20\,000 \cdot m) \\ 1 \text{ if } k = (10\,000 + l + 20\,000 \cdot m) \end{cases} \quad \text{and } l = 0...9999 \text{ and } m = 0...4$$

$$V_{\text{ripple}}[k] = 1 \cdot \sin(50 \cdot \pi \cdot 10^{-3} \cdot s) \text{ with } s = 0...2 \cdot 10^{5} - 1$$

$$V_{\text{testsignal}} = V_{\text{square}}[k] + V_{\text{ripple}}[k]$$

The current waveform is constructed as follows.

An ideal square wave current of 1 A r.m.s. and a frequency of 100 Hz is sampled at a sampling rate of 2 MHz. The sampling starts at the rising edge of the square wave. A sine current wave is superimposed on this square wave. The sine wave has an amplitude of 0,01 A and a frequency of 50 kHz, representing a 1 % current ripple.

$$I_{\text{square}}[k] = (-1)^{x} \cdot 100 \text{ with } x = \begin{cases} 2 \text{ if } k = (l + 20\,000 \cdot m) \\ 1 \text{ if } k = (10\,000 + l + 20\,000 \cdot m) \end{cases} \quad \text{and } l = 0...9999 \text{ and } m = 0...4$$

$$I_{\text{ripple}}[k] = 0{,}1 \cdot \sin(50 \cdot \pi \cdot 10^{-3} \cdot s) \text{ with } s = 0...2 \cdot 10^{5} - 1$$

$$I_{\text{testsignal}} = I_{\text{square}}[k] + I_{\text{ripple}}[k]$$

### F.4.3 Outcome of the test signal

If the calculation of the SPR is done as explained in Clause F.2, the outcome for the here described test signal should be an SPR value of 0,90 %.

# Annex G
(informative)

# Low frequency square wave operation

## G.1 General

This annex is applicable to lamps with nominal power 20 W, 35 W, 50 W, 70 W, 100 W and 150 W.

## G.2 Information for square wave ballast design

Table G.1 provides for specification of parameters for ignition and steady state.

**Table G.1 – Requirements for square wave operation** *(1 of 4)*

| | | | | Super-imposed ignition | Resonant ignition |
|---|---|---|---|---|---|
| *Break down (measurements are done at open circuit)* | | | | Min. | |
| Pulse height at lamp terminals (or at holder or cap) | | | kV | [b] | [a] |
| The ignition pulse parameters have to be fulfilled by the ballast manufacturer for the specified range of capacitances. | | | | | |
| Summed up pulse widths of all pulses higher than or equal to 2,7 kV or 3,15 kV, during a sampling period $t_1$ of (1) or (2), normalised to 1 | | | | | |
| NOTE 1 For schematic drawings, see Annex H. | | | µs/s | [b] | [a] |
| NOTE 2 Limits for maximum frequency and maximum aggregated width are under consideration. | | | | | |
| $\frac{t_{sum}}{t_1} = \frac{1}{t_1}\int_{t=0}^{t_1} f(\lvert U\rvert, t)\,dt$<br>$f = 0 \quad \lvert U\rvert < 2{,}7\,kV$ or $3{,}15\,kV$<br>$f = 1 \quad \lvert U\rvert \geq 2{,}7\,kV$ or $3{,}15\,kV$ | (1)<br>$t_1$ = 30 s | (2)<br>The integral time of $t_1$ shall have two values, 3 s and 30 s (see lamp data sheet). The frequency in each pulse burst shall be ≥3 kHz.<br>NOTE 3 Lower frequencies are under study. | | | |
| Duration of ignition pulse supply | | | min | 15 | [a] |
| For the time range 5 min up to 15 min, for each 60 s [a] interval, the pulse width shall be<br>$\int_{x}^{x+60s} \frac{f(\lvert U\rvert, t)}{60}\,dt$ | | | µs/s | 10 | |
| NOTE 4 The minimum of 15 min applies if the lamp does not ignite before. | | | | | |

**Table G.1** *(2 of 4)*

| | | | | |
|---|---|---|---|---|
| *Take-over (measurements are done at 'resistance at take-over', unless stated otherwise)* | | | | |
| During the electrode heating phase, the ballast shall provide both | | | | |
| (1) lamp power, measured at "resistance at take-over" [b] | W | Min. | 0,25·times rated power for ballast design [a] | |
| (2) lamp r.m.s. current (integration time 500 ms), measured at "resistance at run-up" [b] | A | Min. | typical lamp current [a] | |
| Minimum effective open circuit voltage (OCV), measured at 1 MΩ load | | | Square wave / d.c. | Non-square wave |
| – Ceramic and quartz arc tubes, square wave | V | | 280 | 235 (332 peak) |
| – Ceramic arc tubes only; square wave | V | | 250 | 235 (332 peak) |
| Time duration of requirements for take-over for non-low frequency square wave current (exception: ballasts that are able to detect end of take-over phase): | s | | Max. 5 to 10[a] | |
| Dynamic requirements [a]<br>These should be defined in order to assist proper take-over. | | | | |
| *Run-up (measurements are done at 'resistance at run-up', unless stated otherwise)* | | | | |
| Averaged peak current ratio (APCR)<br>Calculation method:<br>Measure the current waveform on a lamp substitution circuit representing the lamp voltage range from 20 V [c] to 75 V.<br>Determine the maximum PCR value within the measured voltage range by applying a smoothing window of 20 μs.<br>Determine during 1 s, around the determined maximum PCR value, the PCR values for all positive half periods and average the PCR values.<br>Determine during this same 1 s the PCR values for all negative half periods and average the PCR values.<br>The APCR then is the maximum absolute value of both averaged PCR values calculated above.<br>Per definition 3.15, the peak current ratio PCR (see Figure G.3) is defined as the ratio between the peak current and the r.m.s. current. The peak current is determined using the average value over a 20 μs window. All values below the r.m.s. current in the window will be set to the r.m.s. current. The window is slid across the wave shape and the maximum value is the peak current.<br>NOTE 5 This averaging method will smooth out incidental peaks effectively. | | | | APCR < 2 |
| Run-up current: $I_{run\text{-}up}$<br>(= current during the voltage between ca. 20 V and 75 V, prior to the steady state) | | | | |
| $I_{run\text{-}up}$ (r.m.s. value) shall be measured with a resistance. This resistance shall be varied in the range starting from a value defined as resistance at run-up (see lamp data sheet) to a resistance value where 75 V lamp voltage is reached. | | | | |
| Frequency | Hz | | | >1 |
| d.c. current at $V_{lamp}$ < 75 V | % | | | <20 |

**Table G.1** *(3 of 4)*

| *Steady state operation* | | Min. | Max. |
|---|---|---|---|
| Lamp voltage range for output power regulation<br><br>NOTE 6 For possible future lamp designs with a different voltage range, the limits of 75 V and 120 V can be replaced with “lower limit” and “upper limit”. | V | 75 [d] | 120 [d] |
| Output power variation at rated supply voltage (for voltage variation between 75 Vand 120 V)<br><br>NOTE 7 Output power is measured with a resistive load achieving voltages between 75 V and 120 V with steps of 5 V. At each step, sufficient stabilisation time is given before the measurement.<br><br>NOTE 8 For possible future lamp designs with a different voltage range, the limits of 75 V and 120 V can be replaced with “lower limit” and “upper limit”. | % | –5 | 5 |
| Frequency range<br><br>NOTE 9 Light fluctuations can occur when the operation frequency is close to line frequency multiples. | Hz | 70 | 400 |
| DC current component<br><br>The d.c. current component is measured on a resistor.<br><br>NOTE 10 See Figure G.1 and Equation (G.1). | % | | 2,5 |
| Average lamp potential against earth (only with quartz arc tubes, due to sodium loss), positive.<br><br>Contact each electrode as in Figure G.4. Connect the neutral line to earth. Measure *V*mean1 and *V*mean2 with an integration time of 0,5 s. The average voltage is then (*V*mean1 + *V*mean2)/2.<br><br>The circuit in Figure G.4 is an example on how to measure the lamp potential to earth. | V | - | 200 |
| APCR (averaged peak current ratio)<br><br><u>Calculation method:</u><br><br>Measure the current waveform on a lamp substitution circuit representing the lamp voltage range from 75 V to 120 V.<br><br>Determine the maximum PCR value within the measured voltage range by applying a smoothing window of 20 μs.<br><br>Determine during 1 s, around the determined maximum PCR value, the PCR values for all positive half periods and average the PCR values.<br><br>Determine during this same 1 s the PCR values for all negative half periods and average the PCR values.<br><br>The APCR then is the maximum absolute value of both averaged PCR values calculated above.<br><br>For determination of PCR, see run-up.<br><br>NOTE 11 This averaging method will smooth out incidental peaks effectively. | | - | <1,5 |
| Commutation time<br><br>Commutation time measured on a lamp.<br><br>For waveforms that deviate from a square wave near the 90 % levels, 70 % levels may be used be used and the measured time multiplied by 1,3. See Figure G.5 for explanation. | μs | - | 200 |

**Table G.1** *(4 of 4)*

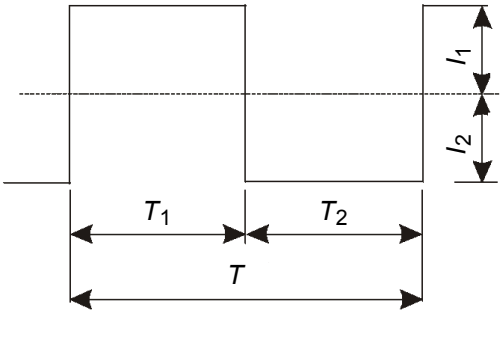
| | | | |
|---|---|---|---|
| HF ripple, expressed as spectral power ratio (SPR):<br>Reduction of the value at frequencies below 120 kHz is under consideration.<br>HF ripple shall be measured on a lamp with voltage within 5 % of the typical lamp voltage given on the relevant lamp data sheet and according to the procedure described in Annex F.<br>NOTE 12 The limitation of the HF ripple serves the limitation of acoustic resonance and flicker. See Figure G.2. | % | 0 | 1,5 |
| Delay time for power reduction in case of lamp overvoltage | min | - | 20 |

[a] Under consideration.

[b] For values, see lamp data sheet.

[c] Under consideration; in the future, this limit might be lowered in view of new lamp developments.

[d] In Japan, different values are valid: For lamp power 35 W and 70 W: minimum 75 V, maximum 115 V. For lamp power 20 W and 150 W: minimum 80 V, maximum 120 V.




$T_1$ and $T_2$ are determined by the electronic controlgear, $I_1$ and $I_2$ by the electronic controlgear and a possible lamp asymmetry. The d.c. component of the electronic controlgear measured with a symmetric resistive load shall not exceed the limits specified under “d.c. current component” on the lamp data sheet.

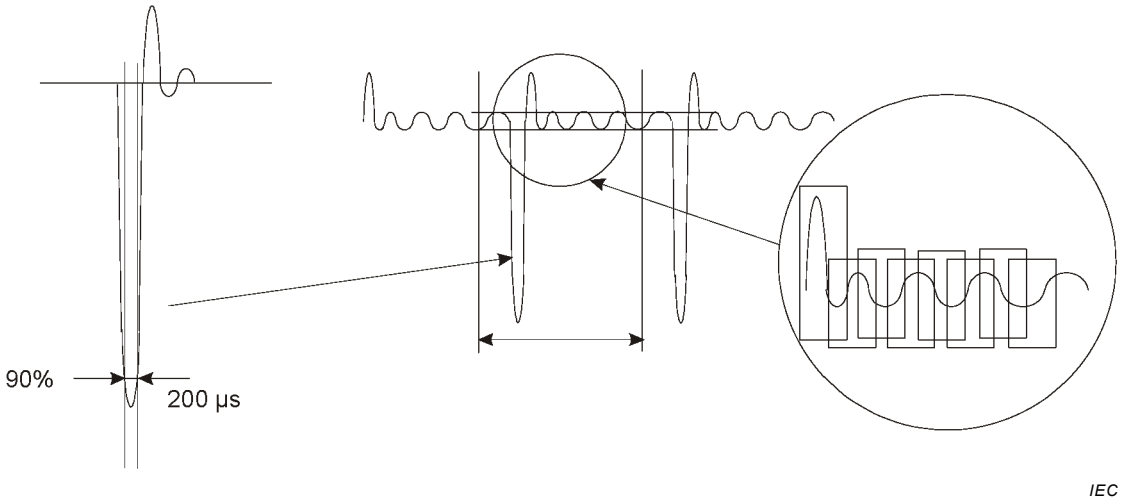
**Figure G.1 – DC current component**

The d.c. current component is calculated according to Equation (G.1).

Equation (G.1): d.c. current component:

$$\text{DC absolute} = \frac{1}{T}\int_0^T \text{idt} = \frac{T_1 \times I_1 - T_2 \times I_2}{T_1 + T_2}\,(\text{A}) \qquad \text{(G.1)}$$

For an explanation of parameters, see Figure G.1.




**a) Commutation** **b) 100 ms FFT window** **c ) 199 overlapping 1 ms windows**

**Figure G.2 – HF ripple and fast Fourier transformation (power curve)**

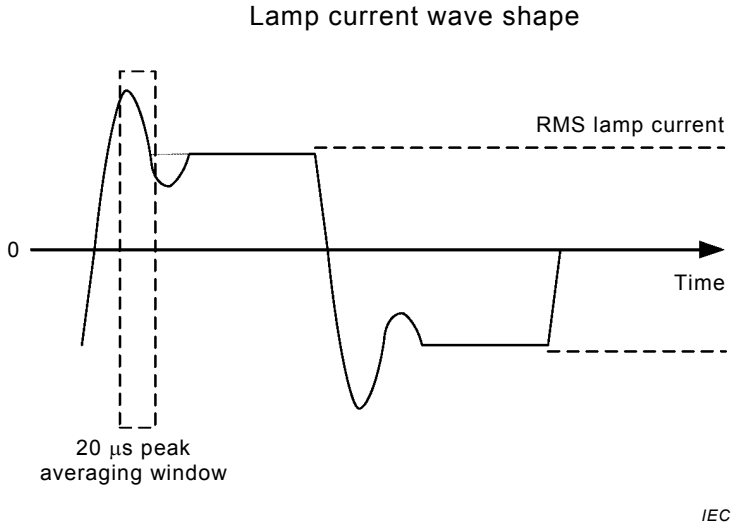



**Figure G.3 – Measurement of PCR during run-up and steady state**

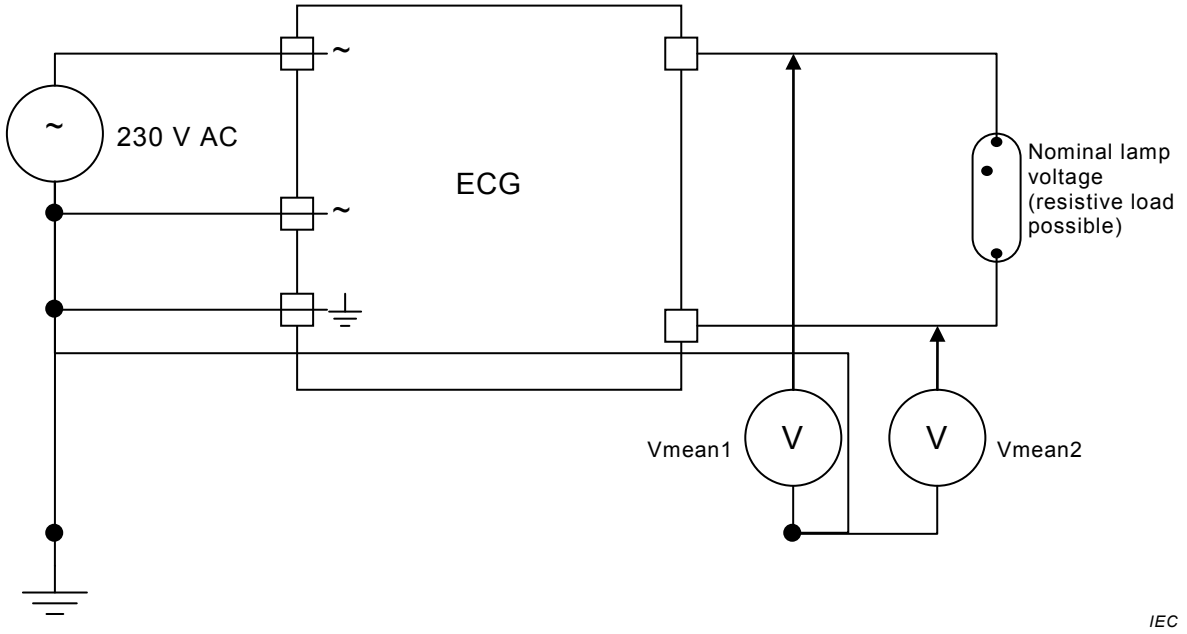



**Figure G.4 – Example of a measurement circuit of lamp potential against earth**

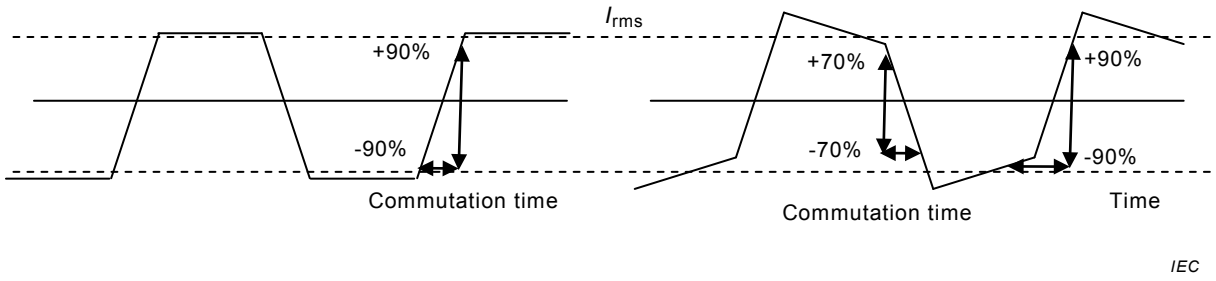



**Figure G.5 – Commutation time, deviating waveform**

# Annex H
(informative)

# Information for ballast design

## H.1 General

The requirements of Annex G and the information given on the lamp data sheets should be observed.

## H.2 Explanation of the ignition schemes

Figures H.1, H.2 and H.3 schematically show the ignition sequences as referred to in Annex G and in the lamp data sheets.

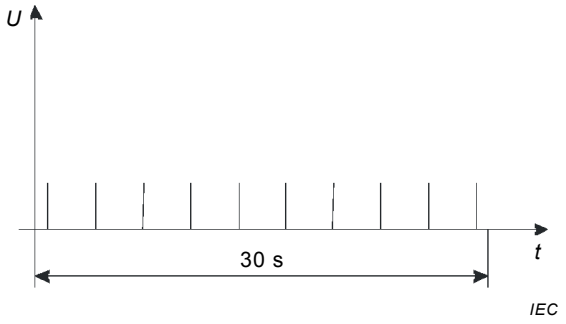



**Figure H.1 – Example 1 for ignition scheme according to option (1) (see Annex G and lamp data sheets)**

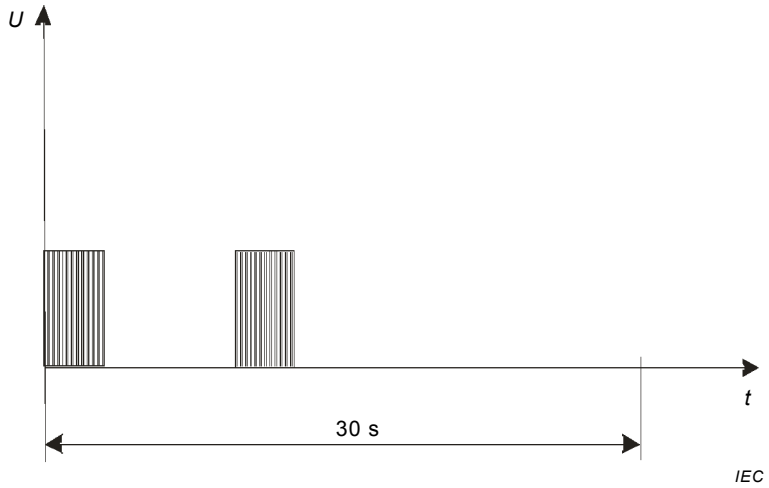



**Figure H.2 – Example 2 for ignition scheme according to option (1) (see Annex G and lamp data sheets)**

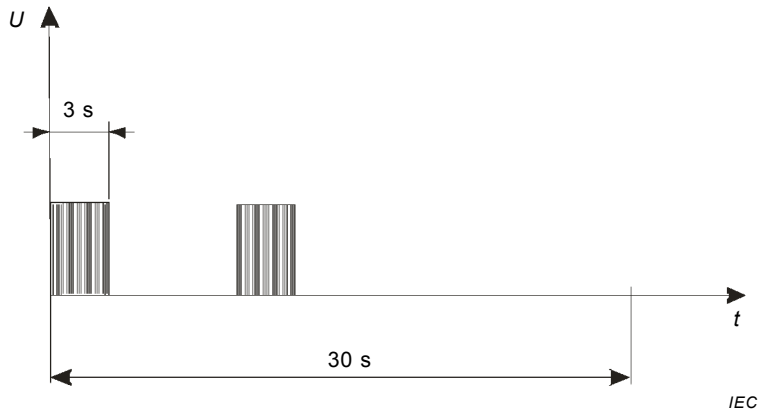



**Figure H.3 – Example for ignition scheme according to option (2) (see Annex G and lamp data sheets)**

# Annex I
(informative)

## Information regarding lamp performance temperature limits for luminaire design

Maximum limits for pinch and outer bulb temperature are given in most of the respective lamp data sheets. For some lamps the limits are left to the manufacturer. The reason is the following.

For some values the limit has a direct physical reason. For hard glass outer bulb for instance the limit is based on the softening temperature of the glass. Exceeding this value would lead to deformation of the glass. For the pinch in a lamp with quartz glass outer bulb, exceeding the limit would lead to oxidation of the molybdenum foil, which is used as a current feed through.

For a lamp with quartz glass outer bulb, the limit has nothing to do with the actual limit for the glass, but is an indirect means to restrict the influence of the luminaire on the lamp.

The outer bulb and arc tube are coupled by radiation, convection and to a small extent by thermal conduction via the leads (see Figure I.1).

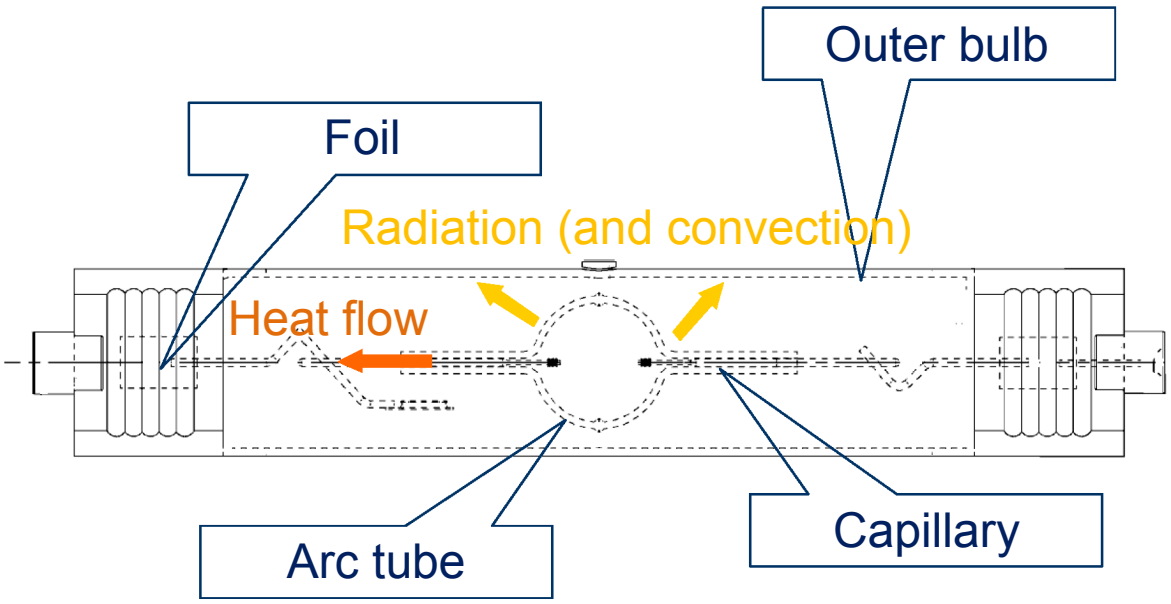



**Figure I.1 – Principle ways of heat transport in a lamp**

The actual outer bulb temperature is influenced by several factors:

- the outer bulb diameter;
- the lamp construction, e.g. second envelope etc.;
- the spectral power distribution of the arc tube, because the outer bulb is partially heated by radiation absorbed by the outer bulb;
- the presence of filling gas (e.g. nitrogen) or vacuum in the outer bulb; and
- the material and glass thickness of the outer bulb, for instance UV filter through doped glass leads generally to higher outer bulb temperatures.

As these factors can easily differ among different lamp manufacturers while still each individual lamp complies with the respective lamp standard, it is hardly possible to give one limit for all lamps of one type. Lamps of different manufacturers can exhibit different temperature values under exactly the same conditions while still performing similarly.

Therefore the temperature limits for these lamps shall be given by the lamp manufacturers individually for their lamps.

It has to be noted that different values do not necessarily mean that the lamps are differently sensitive or can withstand different maximum temperatures but that the resulting (measured) temperatures differ under the same ambient conditions.

Nevertheless, the lamps of different manufacturers covered by one data sheet in IEC 61167 are interchangeable.

Additional note:

It is important to limit the outer bulb temperature, but this is not sufficient to guarantee an optimal performance. An inadequately designed reflector for instance can still cause the arc tube to overheat for example by back reflecting the light to the arc tube without any major change in the outer bulb temperature.

A further indication that a luminaire design is inadequate may be derived from comparing the lamp voltage measured with the lamp operating in free air with the lamp voltage measured with the lamp operating in the luminaire after being left long enough to light up properly. The increased lamp voltage measured in lamps < 400 W in the luminaire should not exceed 5 V.

# Annex J
(informative)

# ILCOS codes

For all lamps having a data sheet in this standard, this annex and Table J.1, gives the ILCOS code according to IEC 61231.

The code does not give all the technical characteristics necessary to specify a lamp fully, but it should aid in the correct replacement of lamps concerning their interchangeability and compatibility.

**Table J.1 – Lamp coding**

| Data sheet | Nominal power | Correlated colour temperature | Version | Cap | ILCOS |
|---|---|---|---|---|---|
| 1020 | 20 | 3 000 | Single-capped | GU6.5 | MT/UB-20/830-H/L-GU6.5-13,3/52 |
| 1025 | 20 | 3 000 | Single-capped | G8.5 | MT/UB-20/830-H/L-G8.5-17/85 |
| 1027 | 20 | 3 000 | Single-capped | G12 | MT/UB-20/830-H/L-G12-20/90 |
| 1030 | 35 | 3 000 | Single-capped | GU6.5 | MT/UB-35/830-H/L-GU6.5-13,3/52 |
| 1035 | 35 | 3 000 | Single-capped | G8.5 | MT/UB-35/830-H/SL-G8.5-17/85 |
| 1037 | 35 | 4 200 | Single-capped | G8.5 | MT/UB-35/842-H/SL-G8.5-17/85 |
| 1039 | 35 | 3 000 | Single-capped, self-protected | GU8.5 | MTS/UB-35/830-H/L-GU8.5-23/92 |
| 1041 | 35 | 4 200 | Single-capped, self-protected | GU8.5 | MTS/UB-35/842-H/L-GU8.5-23/92 |
| 1043 | 35 | 3 000 | Single-capped | G12 | MT/UB-35/830-H/SL-G12-20/90 |
| 1045 | 35 | 4 200 | Single-capped | G12 | MT/UB-35/842-H/SL-G12-20/90 |
| 1050 | 50 | 3 000 | Single-capped | GU6.5 | MT/UB-50/930-H/L-GU6.5-13,3/52 |
| 1052 | 50 | 3 000 | Single-capped | G8.5 | MT/UB-50/930-H/SL-G8.5-17/85 |
| 1054 | 50 | 3 000 | Single-capped | G12 | MT/UB-50/930-H/SL-G12-20/90 |
| 1070 | 70 | 3 000 | Single-capped, tubular | E27 | MT/UB-70/830-H/SL-E27-39/156 |
| 1072 | 70 | 3 000 | Single-capped, elliptical, self-protected | E27 | MES/UB-70/[a]30-H/SL-E27-57/144 |
| | | | | | MCS/UB-70/[a]30-H/SL-E27-57/144 |
| 1074 | 70 | 4 200 | Single-capped, elliptical, self-protected | E27 | MES/UB-70/[a]42-H/SL-E27-57/144 |
| | | | | | MCS/UB-70/[a]42-H/SL-E27-57/144 |
| 1076 | 70 | 3 000 | Single-capped | G8.5 | MT/UB-70/830-H/SL-G8.5-17/85 |
| 1078 | 70 | 4 200 | Single-capped | G8.5 | MT/UB-70/942-H/SL-G8.5-17/85 |
| 1080 | 70 | 3 000 | Single-capped, self-protected | GU8.5 | MTS/UB-70/830-H/L-GU8.5-23/92 |
| 1082 | 70 | 4 200 | Single-capped, self-protected | GU8.5 | MTS/UB-70/842-H/L-GU8.5-23/92 |
| 1084 | 70 | 3 000 | Single-capped | G12 | MT/UB-70/830-H/SL-G12-26/76 |
| 1086 | 70 | 4 200 | Single-capped | G12 | MT/UB-70/842-H/SL-G12-26/76 |
| 1100 | 100 | 3 000 | Single-capped, elliptical, self- | E27 | MES/UB-100/930[b]-H/SL-E27-57/144 |

| Data sheet | Nominal power | Correlated colour temperature | Version | Cap | ILCOS |
|---|---|---|---|---|---|
| | | | protected | | MCS/UB-100/930[b]-H/SL-E27-57/144 |
| 1105 | 100 | 4 200 | Single-capped, elliptical, self-protected | E27 | MES/UB-100/942[b]-H/SL-E27-57/144 |
| | | | | | MCS/UB-100/942[b]-H/SL-E27-57/144 |
| 1110 | 100 | 3 000 | Single-capped | G12 | MT/UB-100/830-H/SL-G12-20/100 |
| 1115 | 100 | 4 200 | Single-capped | G12 | MT/UB-100/942-H/SL-G12-20/100 |
| 1150 | 150 | 3 000 | Single-capped, elliptical, self-protected | E27 | MES/UB-150/[a]30-H/SL-E27-57/144 |
| | | | | | MCS/UB-150/[a]30-H/SL-E27-57/144 |
| 1152 | 150 | 4 200 | Single-capped, elliptical, self-protected | E27 | MES/UB-150/[a]42-H/SL-E27-57/144 |
| | | | | | MCS/UB-150/[a]42-H/SL-E27-57/144 |
| 1154 | 150 | 3 000 | Single-capped, tubular | E40 | MT/UB-150/830-H/SL-E40-48/211 |
| 1156 | 150 | 3 000 | Single-capped | G12 | MT-150/830-H/SL-G12-26/76 |
| | | | | | MT/UB-150/830-H/SL-G12-26/76 |
| 1158 | 150 | 4 200 | Single-capped | G12 | MT-150/842-H/SL-G12-26/76 |
| | | | | | MT/UB-150/842-H/SL-G12-26/76 |
| 2015 | 20 | 3 000 | Reflector PAR20, self-protected | E27 | MRS/UB-20/830-H/L-E27-63,5/96/ [c] |
| 2020 | 20 | 3 000 | Reflector PAR30, self-protected | E27 | MRS/UB-20/830-H/L-E27-95/125/ [c] |
| 2022 | 20 | 3 000 | Reflector R111, self-protected | GX8.5 | MRS/UB-20/830-H/L-GX8.5-111/88/ [c] |
| 2024 | 20 | 3 000 | Reflector MR16, self-protected | GX10 | MRS/UB-20/830-H/L-GX10-51/54,5/ [c] |
| 2035 | 35 | 3 000 | Reflector PAR20, self-protected | E27 | MRS/UB-35/830-H/SL-E27-63,5/96/ [c] |
| 2037 | 35 | 3 000 | Reflector PAR30, self-protected | E27 | MRS/UB-35/830-H/SL-E27-95/125/ [c] |
| 2039 | 35 | 4 200 | Reflector PAR20, self-protected | E27 | MRS/UB-35/942-H/SL-E27-63,5/96/ [c] |
| 2041 | 35 | 3 000 | Reflector R111, self-protected | GX8.5 | MRS/UB-35/830-H/SL-GX8.5-111/88/ [c] |
| 2043 | 35 | 4 200 | Reflector R111, self-protected | GX8.5 | MRS/UB-35/842-H/SL-GX8.5-111/88/ [c] |
| 2045 | 35 | 3 000 | Reflector MR16, self-protected | GX10 | MRS/UB-35/830-H/L-GX10-51/54,5/ [c] |
| 2050 | 50 | 3 000 | Reflector PAR20, self-protected | E27 | MRS/UB-50/930-H/SL-E27-63,5/96/ [c] |
| 2052 | 50 | 3 000 | Reflector PAR30, self-protected | E27 | MRS/UB-50/930-H/SL-E27-95/125/ [c] |
| 2054 | 50 | 3 000 | Reflector R111, self-protected | GX8.5 | MRS/UB-50/930-H/SL-GX8.5-111/88/ [c] |
| 2056 | 50 | 3 000 | Reflector MR16, self-protected | GX10 | MRS/UB-50/930-H/L-GX10-51/54,5/ [c] |

| Data sheet | Nominal power | Correlated colour temperature | Version | Cap | ILCOS |
|---|---|---|---|---|---|
| 2070 | 70 | 3 000 | Reflector PAR30, self-protected | E27 | MRS/UB-70/830-H/SL-E27-95/125/ [c] |
| 2072 | 70 | 4 200 | reflector PAR30, self-protected | E27 | MRS/UB-70/842-H/SL-E27-95/125 [c] |
| 2074 | 70 | 3 000 | Reflector R111, self-protected | GX8.5 | MRS/UB-70/830-H/SL-GX8.5-111/88/ [c] |
| 2076 | 70 | 4 200 | Reflector R111, self-protected | GX8.5 | MRS/UB-70/842-H/SL-GX8.5-111/88/ [c] |
| 3070 | 70 | 3 000 | Double-capped | RX7s | MD-70/830-H/SL-RX7s-22/117,6 |
| 3075 | 70 | 4 200 | Double-capped | RX7s | MD-70/842-H/SL-RX7s-22/117,6 |
| 3150 | 150 | 3 000 | Double-capped | RX7s-24 | MD-150/830-H/SL-RX7s=24-25/135,4 |
| 3155 | 150 | 4 200 | Double-capped | RX7s-24 | MD-150/842-H/SL-RX7s=24-25/135,4 |
| 3250 | 250 | 4 200 | Double-capped | Fc2 | MD-250/842-H/L-Fc2-27,5/139 |

[a] Lamps according to these data sheets can have different CRI values depending on the technology used. The number representing colour rendering index in the ILCOS code will vary accordingly.

[b] Lamps according to these data sheets can have different CRI values and colour targets depending on the technology used. The numbers representing colour rendering index and colour temperature in the ILCOS code will vary accordingly.

[c] Reflector lamps according to these data sheets can have different values of beam angle depending on the design. The number representing beam angle in the ILCOS code will vary accordingly.

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〈C〉 NOTE Harmonized as EN 60081. 〈C〉

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〈C〉 COMMISSION REGULATION (EC) No 245/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council

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**BSI Group Headquarters**

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