



IEC 61167

Edition 2.0 2011-03

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

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**Metal halide lamps – Performance specification**

**Lampes aux halogénures métalliques – Spécifications de performance**



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**Metal halide lamps – Performance specification**

**Lampes aux halogénures métalliques – Spécifications de performance**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE **XG**  
CODE PRIX

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ICS 29.140.30

ISBN 978-2-88912-411-4

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### METAL HALIDE LAMPS – PERFORMANCE SPECIFICATION

#### FOREWORD

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

This second edition replaces the first edition published in 1992 and its Amendments 1 (1995), 2 (1997) and 3 (1998). This second edition constitutes a technical revision.

Compared to the 1<sup>st</sup> edition, measurement methods for electrical and photometric parameters are included and safety related requirements are deleted as far as they are now covered by IEC 62035. Modern kind of ignition (e.g. aggregated pulse widths) and operation (low frequency square wave) is added with extensive description of methods of calculation for peak current ratio. At the same time, a review was made on lamps in the market which are fit for standardising, leading to a big number of new lamp data sheets in the range of 20 W up to 250 W lamp power.

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

FDIS	Report on voting
34A/1442/FDIS	34A/1458/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.

## INTRODUCTION

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 3000 K and 4200 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.

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## 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.

NOTE 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 with the tolerances given in the standard that 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.

### 2 Normative references

The following reference documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the reference 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 The definition covers clear and coated lamps.

[IEC 60050-845:1987, 845-07-25, modified]

#### 3.2

##### **nominal value**

approximate quantity value used to designate or identify a lamp

[IEC 60081:1997, Definition 1.4.3, Amendment 2:2003]

#### 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.

[IEC 60081:1997, Definition 1.4.4, Amendment 2:2003]

#### 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 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 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.

#### 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

[IEC 60081:1997, Definition 1.4.10, Amendment 1:2000]

### 3.9

#### **specific effective radiant UV power**

effective power of the UV radiation of a lamp related to its luminous flux (Unit: mW/klm)

NOTE 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 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 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 rms.

### 3.15

#### **peak current ratio**

#### **PCR**

ratio between the peak currents and the r.m.s. currents

NOTE For measurement procedure, see Annex G.

### 3.16

#### **typical lamp voltage, typical lamp current**

steady state lamp voltage and current expected for a lamp operating on low frequency square wave ballast.

NOTE Typical lamp current is derived from the lamp rated wattage 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**

#### **commutation time**

(also referred to as fall and rise time) transition time of lamp current at half cycle polarity reversals

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.

## **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.

### **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...110 V.

NOTE For these lamps the power control of the ballast allows 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  $\pm 25$  % 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.

#### **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**

Under consideration.

#### **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.

## 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. 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 wattage 35 W/70 W/150 W, rated wattage for electronic ballast design is 39 W/73 W/147 W.

## 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**

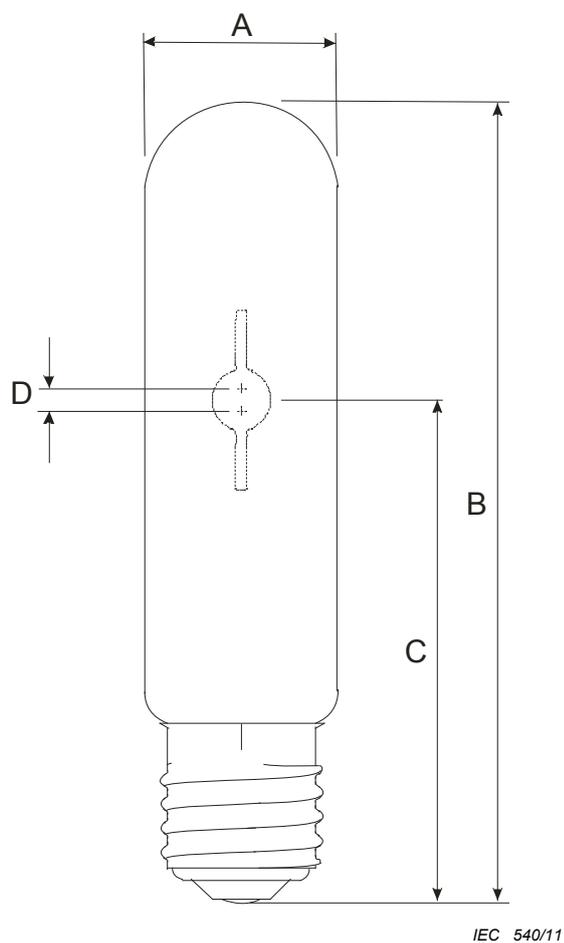
Sheet number 61167-IEC-	Description	Cap
0010	Single-capped	E27 and E40, tubular
0015	Single-capped	E27 and E40, elliptical
0020	Single-capped	GU6.5
0025	Single-capped	G8.5
0030	Single-capped	GU8.5
0035	Single-capped	G12
0210	Reflector	E27
0215	Reflector	GX8.5
0220	Reflector	GX10
0110	Double-capped	RX7s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

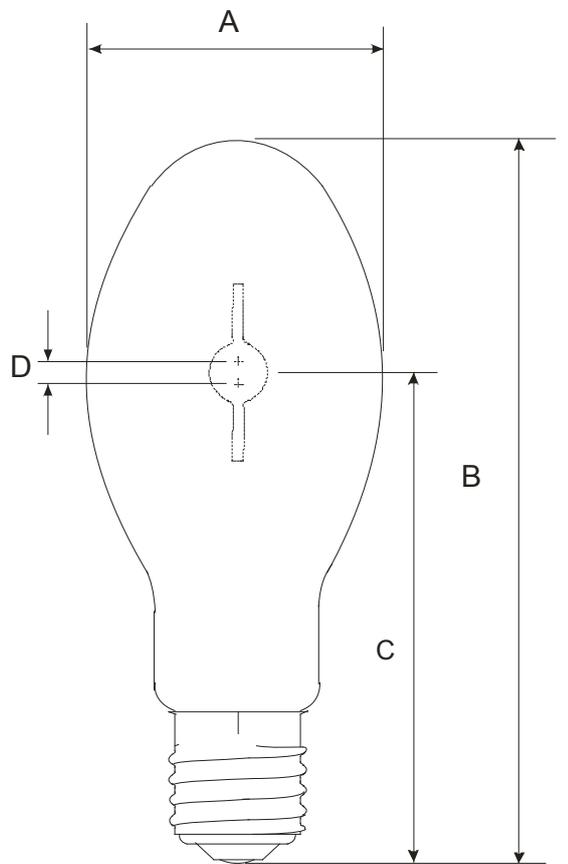
\* See sheet 7004-21 (E27) or 7004-24 (E40) of IEC 60061-1

**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.*



IEC 541/11

**Key**

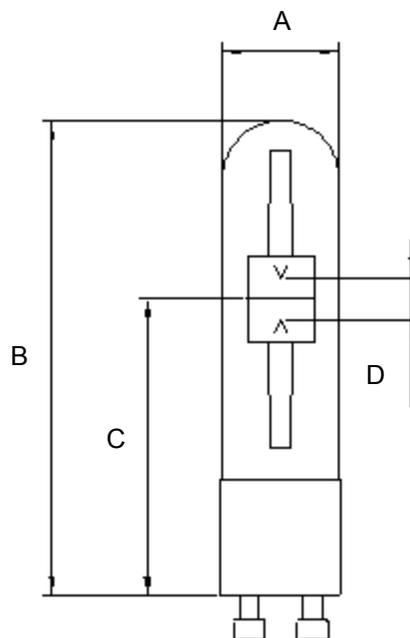
- A Diameter
- B Distance from reference plane to bulb top = total lamp length
- C Light centre length
- D Arc length

\* 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**

GU6.5 cap\*

*Reference plane is the lower cap rim.*



IEC 542/11

**Key**

- A Diameter
- B Distance from reference plane to bulb top
- C Light centre length
- D Arc length

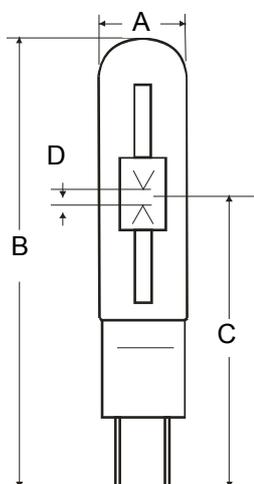
\* See sheet 7004-152 of IEC 60061-1

**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.*



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**Key**

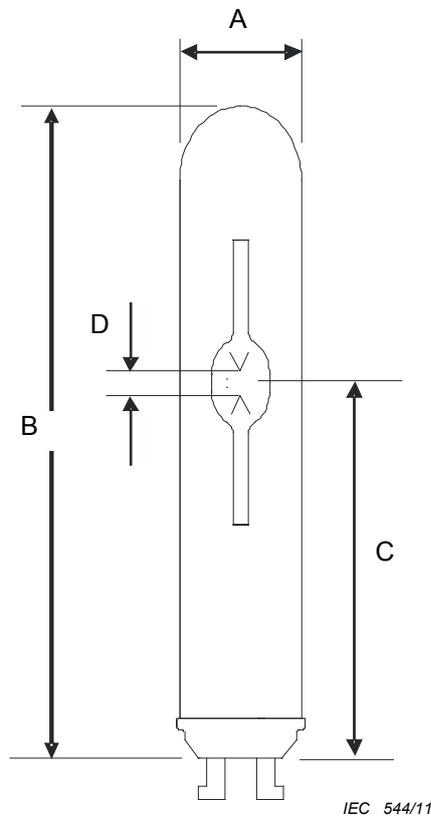
- A Diameter
- B Distance from reference plane to bulb top
- C Light centre length
- D Arc length

\* See sheet 7004-122 of IEC 60061-1

**DIAGRAMMATIC DATA SHEET  
FOR LOCATION OF SINGLE-CAPPED  
METAL HALIDE LAMP DIMENSIONS**

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-xxx of IEC 60061-1