BS EN 60662:2012

BSI Standards Publication

High-pressure sodium vapour lamps — Performance specifications

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National foreword

This British Standard is the UK implementation of EN 60662:2012. It is derived from IEC 60662:2011. It supersedes BS EN 60662:1993 which is withdrawn.

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 committee 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.

Published by BSI Standards Limited 2012

ISBN 978 0 580 61028 8

ICS 29.140.30

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 30 June 2012.

Amendments issued since publication

Amd. No.	Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60662

May 2012

ICS 29.140.30

Supersedes EN 60662:1993 + A4:1994 + A5:1994 + A6:1994 + A7:1995 + A9:1997 + A10:1997

English version

High-pressure sodium vapour lamps - Performance specifications

(IEC 60662:2011, modified)

Lampes à vapeur de sodium à haute pression -
Spécifications de performance
(CEI 60662:2011, modifiée)

Natriumdampf-Hochdrucklampen -
Anforderungen an die Arbeitsweise
(IEC 60662:2011, modifiziert)

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

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 60662:2012 E

Foreword

This document (EN 60662:2012) consists of the text of IEC 60662:2011 prepared by SC 34A, "Lamps, of IEC TC 34, Lamps and related equipment", together with the common modifications prepared by CLC/SR 34 "Lamps and related equipment".

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) 2013-01-02
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-01-02

This European Standard supersedes EN 60662:1993 + A4:1994 + A5:1994 + A6:1994 + A7:1995 + A9:1997 + A10:1997.

Main items that required development of EN 60662:2011 are:

— restriction to performance requirements. Safety requirements are given in EN 62035: *Discharge lamps (excluding fluorescent lamps) – Safety specifications*;

— introduction of a test device for ignition;

— split of the lamp data sheets which make use of the test device and those which do not;

— provisions for measurement during starting, measurement of electrical and photometrical characteristics and tests for lumen maintenance and life;

— general review e.g. of maximum lamp outlines and alignment of data;

— new order of data sheets by wattage.

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

Endorsement notice

The text of the International Standard IEC 60662:2011 was approved by CENELEC as a European Standard with common modifications.

COMMON MODIFICATIONS

Lamps with the following caps are excluded from EN 60662, as they do not comply with European safety requirements:

E26

E39.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60081:1997 NOTE Harmonized as EN 60081:1998 (not modified).

IEC 61231 NOTE Harmonized as EN 61231.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced 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 referenced document (including any amendments) applies.

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

Publication	Year	Title	EN/HD	Year
IEC 60050-845	1987	International Electrotechnical Vocabulary (IEV) - Chapter 845: Lighting	-	-
IEC 60061-1 (mod)	-	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 1: Lamp caps	EN 60061-1	-
IEC 60061-3	-	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 3: Gauges	EN 60061-3	-
IEC 60923 + A1	2005 2006	Auxiliaries for lamps - Ballasts for discharge lamps (excluding tubular fluorescent lamps) - Performance requirements	EN 60923 + A1	2005 2006
IEC 61347-2-1	-	Lamp controlgear - Part 2-1: Particular requirements for starting devices (other than glow starters)	EN 61347-2-1 + corr. July + corr. December	-
IEC 62035 (mod)	-	Discharge lamps (excluding fluorescent lamps) - Safety specifications	EN 62035	-

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INTRODUCTION

The relation between data sheet numbers of the first and the second edition is given below.

Lamp data sheets							
1st edition	2nd edition		1st edition	2nd edition		1st edition	2nd edition
1010	3250		1090	1105		2120	3300
1010	3255		1100	9000		2120	3305
1010	3260		1110	0770		2130	3310
1020	3265		1120	0775		2130	3315
1020	3270		1130	0780		2140	4500
1030	4400		1140	0785		2140	4505
1030	4405		1150	9005		2150	4510
1030	4410		1160	9010		2150	4515
1040	4415		1170	0550		3010	2300
1040	4420		1180	0555		3020	3400
1050	2150		1190	0560		3030	4600
1050	2155		-	6000		4010	3500
1060	2160		2100	2200		4020	3505
1060	2165		2110	2210		4030	4700
1070	1119		2110	2215		4040	4705
1080	1100						

Lamp outline sheets				
1st edition	2nd edition		1st edition	2nd edition
-	150 01		9030 mod.	400 01
9010	250 01		9031	400 02
9011	250 02		9032	400 03
9012 mod.	250 03		9040 mod.	400 04
9020	250 04			

HIGH-PRESSURE SODIUM VAPOUR LAMPS – PERFORMANCE SPECIFICATIONS

1 Scope

This International Standard specifies performance requirements for high-pressure sodium vapour lamps for general lighting purposes which comply with the safety requirements of IEC 62035.

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 dealing with the lamp starting test and associated information for ballast/ignitor design are different depending on the practice of the country in which the lamp type was originally developed.

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 referenced 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 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 60061-3, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 3: Gauges*

IEC 60923:2005, *Auxiliaries for lamps – Ballasts for discharge lamps (excluding tubular fluorescent lamps) – Performance requirements*[1]
Amendment 1 (2006)

IEC 61347-2-1, *Lamp controlgear – Part 2-1: Particular requirements for starting devices (other then glow starters)*

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

3 Terms and definitions

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

[1)] There exists a consolidated edition 3.1 that comprises edition 3 and its Amendment 1.

3.1
high-pressure sodium vapour lamp
high-intensity discharge lamp in which the light is produced mainly by radiation from sodium vapour operating at a partial pressure of the order of 10 kilopascals

NOTE The term covers lamps with clear or diffusing bulb.

[IEC 60050-845 :1987, 845-07-23]

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

[IEC 60081:1997, definition 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.

[IEC 60081:1997, definition 1.4.4]

3.4
reference ballast
special inductive type ballast, 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

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 magnetic surroundings, as outlined in the relevant ballast standard.

3.5
calibration current
value of the current on which the calibration and control of the reference ballast are based

3.6
type test
test or 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]

3.7
type test sample
sample consisting of one or more similar units submitted by the manufacturer or responsible vendor for the purpose of a type test

[IEC 60081:1997, definition 1.4.11]

4 General lamp requirements

4.1 Conditions on safety

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

4.2 Expectations on performance

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 clauses.

The requirements and information given apply to 95 % of production.

4.3 Classification

For the purpose of this standard, the following designations are used as a classification according to the rated voltage at lamp terminals:

Lamp voltage designation	Abbreviation	Lamp voltage range V
Low lamp voltage	LV	< 70
High lamp voltage	HV	70 to 180
Extra high lamp voltage	EHV	> 180

5 Marking

In addition to lamp marking requirements prescribed in IEC 62035, the following symbols, indicating the starting method shall be marked on the lamp:

– for lamps without an internal starting device and requiring an external ignitor 

– for lamps having an internal starting device 

NOTE In the U.S.A., lamps are marked with an electrical code that is used to identify the proper ballast. See local standards. The symbols are not required or used in U.S.A.

6 Dimensions

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

7 Caps

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

8 Test requirements for lamp starting, warm-up, electrical and photometric characteristics

8.1 General

For the tests for lamp starting, lamp warm-up and lamp electrical characteristics the lamps shall be operated in a horizontal position in free air and at an ambient temperature of 25 °C ± 5 °C, on a 50 Hz or 60 Hz sinusoidal power supply using the specified reference ballast at voltage specified on the lamp data sheet. Lamps shall not be operated during 5 h immediately prior to making the starting test.

8.2 Lamp starting test

8.2.1 Lamps with external ignitor

In view of various types of ignitors in the market using essentially different methods for ignition, a well-defined reference device[2] allows to determine whether a lamp is ignitable in the sense of the standard or not. Since the device also is the basis for comparable measurements, essential component changes are not permitted unless the responsible IEC maintenance team has agreed the changes.

All variable starting parameters are given on the lamp data sheet and refer to either adjustments of the device or to an implicit property thereof (e.g. waveshape), see Figure A.1 for pulse features. If the lamp data sheet requires a second pulse, during the negative half

[2] The device can be obtained for example from Spitzenberger + Spies, D-94234 Viechtach, Germany. Brand name is LSTI5. This information is given for the convenience of users of this document and does not constitute an endorsement by the IEC of the product named.

cycle, the shape of this second pulse is according to Figure A.2. The fixed settings of the reference device are given in Annex F.

The pulse characteristics specified on the relevant lamp data sheet are measured at the device output terminals in open circuit condition.

NOTE In U.S.A., the reference device is not used. A description of the pulse is given in Figure A.3. The starting pulse is measured with a simulated lamp-load of 20 pF across the lampholder terminals.

The circuit connections for lamp starting shall be such that the pulse is applied to the lamp through the eyelet terminal of the cap and with the shell substantially at earth potential.

8.2.2 Lamps with internal starting device

The test voltage shall be as indicated in the relevant lamp data sheet. The starting time measured from applying the test voltage shall not exceed the maximum value shown on the lamp data sheets.

8.3 Lamp warm-up test

Prior to the warm-up test, the lamps shall have been aged for a minimum of 10 h using a suitable production ballast and cooled for a minimum of 1 h prior to the test.

The voltage at lamp terminals shall reach a minimum value within the time specified on the relevant lamp data sheet.

8.4 Ageing

Before the initial readings are taken the lamp shall be subjected to ageing for 100 h. This operation may be carried out on a production ballast.

8.5 Lamp electrical characteristics

The lamp electrical characteristics shall comply with the values given in the relevant lamp data sheet, using the measuring method given in Annex G. During measurement of the electrical characteristics, the external ignitor shall be disconnected from the lamp circuit.

8.6 Extinguishing voltage test

This test shall only be carried out on lamps where an extinguishing voltage is shown on the lamp data sheet.

The lamp shall be operated on a reference ballast at rated supply voltage and at the extinguishing voltage shown on the lamp data sheet, achieved, if necessary, by artificial means. This lamp shall not extinguish when the supply voltage falls from 100 % to 90 % of the rated value in less than 0,5 s and remains at that value for at least 5 s.

8.7 Photometric characteristics

Requirements are under consideration. For methods of measuring, see Annex G.

8.7 Colour characteristics

Requirements are under consideration. For methods of measuring, see Annex G.

8.9 Lumen maintenance and life

Requirements are under consideration. For methods of measuring, see Annex H.

9 Information for ballast and ignitor design

9.1 General

Ballasts and ignitors should meet the following requirements to ensure reliable starting and operating conditions. These checks do not constitute lamp requirements.

Except where noted otherwise, these requirements should be met over the range of 92 % to 106 % of the rated voltage of the ballast.

9.2 Information for ignitor design (external type)

An ignitor should start lamps which comply with the specified lamp starting test.

The ignition reference device settings on the data sheets are only for lamp start testing and are not intended to predetermine any practical ignitor properties.

In designing an ignitor, account should be taken of pulse attenuation due to cable capacitive loading.

9.3 Information for ballast design

9.3.1 General

The ballast specification should require the ignitor to be provided with information concerning the maximum value of capacitance consistent with achieving the specified requirements for lamp starting.

9.3.2 Current crest factor

The current crest factor should comply with the requirements of 9.1 of IEC 60923.

9.3.3 Lamp operating limits for the information of ballast designers (see Annex C)

Each of the lamp operating sheets shows a diagram of the lamp voltage and lamp wattage limits within which the lamp should be operated. The minimum voltage limit (left-hand side of the diagram) is the characteristic curve of a lamp whose voltage at rated wattage is the minimum considered acceptable.

The maximum voltage limit (right-hand side of the diagram) is the characteristic curve having a voltage high enough to allow for a lamp with:

a) maximum zero-hour voltage;

b) voltage rise during life;

c) maximum voltage rise due to enclosure in a luminaire.

The wattage limit lines (top and bottom of the diagram) are chosen with regard to the effect of lamp wattage on performance factors such as initial light output, lumen maintenance, lamp life, lamp warm-up etc.

The supply voltage limits for lamp operation on reactor (choke) ballasts should be as shown below. The upper supply voltage limit should not be exceeded continuously in lamp use, otherwise special precautions are necessary. Short-term excursions above this limit can be tolerated.

The voltage limits are:

a) for rated supply voltages between 100 V and 150 V:
   - between 95 % and 105 % of rated voltage of the ballast;

b) for rated supply voltages between 220 V and 240 V:
   - the lower supply voltages limit is 95 % of rated voltage of the ballast;
   - the upper supply voltage limits are:
     - for lamp ratings below 150 W: rated voltage of the ballast + 7 V
     - for lamp ratings 150 W and above: rated voltage of the ballast + 10 V.

The lamp wattage obtained with a reference lamp when measured on a ballast at rated voltage, should comply with the requirements of Clause 15 of IEC 60923.

Lamp operating limits and a typical ballast characteristic are given as part of each lamp data sheet.

9.4 North American starting pulse characteristics

The ignitor may be an integral part of the ballast or a separate device. In either case it should meet the following general requirements along with those given on the lamp data sheet.

The starting pulse application should be to the eyelet or centre lampholder terminal with the wiring between ballast and lampholder (or its equivalent capacitance) connected.

The starting pulse measurement should be at the lampholder terminals with a simulated lamp-load of 20 pF across the terminals. The pulse height should be measured from zero voltage level of the supply voltage. The minimum pulse repetition rate should be once per cycle for lag circuit ballasts and once per half cycle for lead circuit ballasts.

The pulse position for lag circuit ballasts should be (1) during the time that the open-circuit voltage exceeds 90 % of its peak and (2) no later than 20 electrical degrees beyond the centre of the half cycle (that is, 110 degrees or 290 degrees, or both).

The pulse position for lead circuit ballasts should be (1) during the time that the open-circuit voltage exceeds 90 % of its peak and (2) no later than 15 electrical degrees beyond the centre of the half cycle (that is, 105 degrees and 285 degrees).

Low current off time is given on the relevant lamp data sheet.

NOTE The low current off time is defined by the time that the instantaneous current at the end of each half cycle is below 1,0 A. This specification is needed for CWA (= constant wattage autotransformer) ballasts.

10 Information for luminaire design

NOTE This information refers to the luminaire design checks necessary to ensure that conditions in the luminaire do not cause premature failure of lamps complying with this standard. These checks do not constitute lamp requirements.

10.1 Voltage increase at lamp terminals

The lamp voltage increase as determined in accordance with the relevant procedure given in Annex D should not exceed the value specified on the relevant lamp data sheet.

Tests should be carried out in accordance with the relevant requirements of Annex D.

10.2 Lamp envelope temperatures

The lamp envelope temperature, when measured at any point, should not exceed the following.

– European practice

150 W or lower	310 °C
above 150 W (except 600 W)	400 °C
600 W	480 °C (under consideration)

– North American practice

bulb type RL38	385 °C
else	400 °C

– Japanese practice

70 W and lower	385 °C
above 70 W	400 °C

During the measurement, the lamp should be operated at its rated wattage.

NOTE 1 These values do not apply to lamps with quartz outer bulbs.

NOTE 2 The limitations in 10.2 should be regarded with caution. These are limitations imposed by the lamp materials, but it should be understood that, in general, if the luminaire causes a lamp to reach these temperatures, it is probable that the voltage rise limitation in 10.1 will be exceeded.

11 Maximum lamp outlines

Maximum lamp outline requirements are provided for the guidance of designers of luminaires and are based on a maximum-sized lamp inclusive of bulb to cap eccentricity, see Annex I.

Observance of these requirements in luminaire design will ensure mechanical acceptance of lamps complying with this standard.

Mechanical acceptance of the lamp cap and adjoining part of the lamp neck in the holder is ensured by compliance of the lamp with the gauges for testing contact-making as given in IEC 60061-3.

12 Numbering system for lamp data sheets

The first number represents the number of this publication (IEC 60662) followed by the letters “IEC”.

The second number represents the lamp data sheet number.

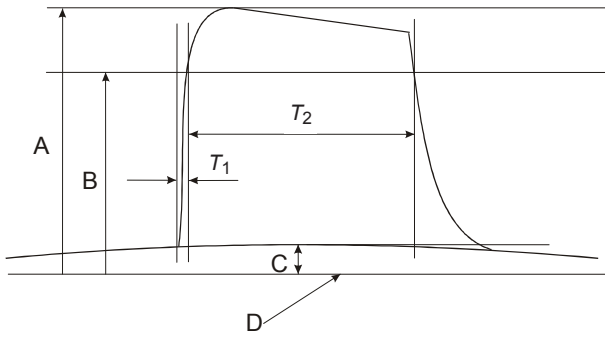
The third number represents the edition of the page of the data sheet. In cases where a data sheet has more than one page, it is possible for the pages to have different edition numbers, with the data sheet number remaining the same.

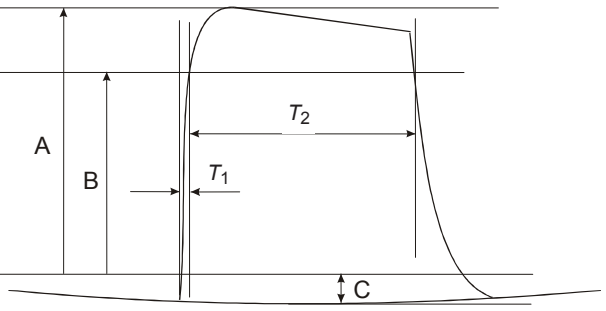
Annex A
(normative)

Waveshape of voltage pulses for lamp starting test (schematic drawings)

A.1 Waveshapes obtained with the reference device

The waveshapes which are obtained with the reference device as mentioned in 8.2, footnote, are presented as examples in Figure A.1 and Figure A.2.





Key

A potential difference between maximum pulse height and zero voltage level (D) of the open-circuit voltage

B 90 % of *A*

T_1 rise time of the pulse

C $\sqrt{2}$ x the test voltage (r.m.s.) as specified on the lamp data sheet

D zero voltage level

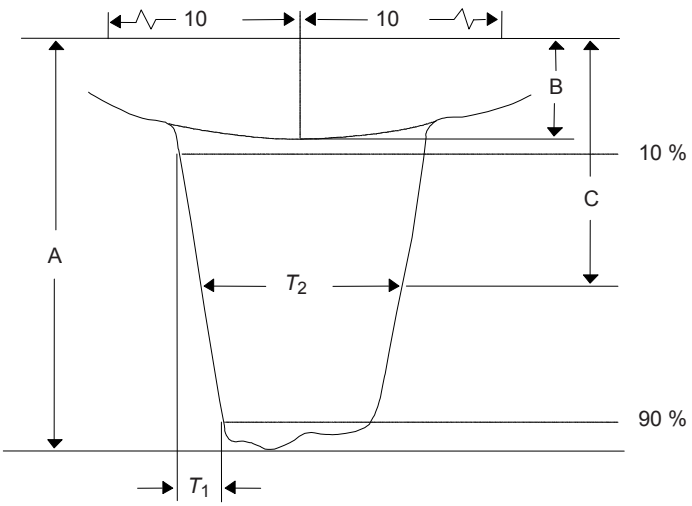
T_2 duration time of the pulse as specified on the lamp data sheet

Figure A.1 – Waveshape: positive pulse during positive half cycle

Figure A.2 – Waveshape: positive pulse during negative half cycle

A.2 Practice in North America

The starting pulse shall have the following characteristics, as measured with a simulated lamp-load of 20 pF across the lampholder terminals. The pulse shape shall be a square wave as defined in Figure A.3. The rise time T_1 is the time interval between the instantaneous amplitudes of 10 % and 90 %, from the separation from the open circuit voltage, of the peak pulse amplitude. The pulse width T_2 is the time interval across the pulse at *C* (50 % of *A*). The pulse height *A* shall be measured from the zero voltage level of the supply voltage. The repetition rate of the pulse shall be once per cycle. The pulse position on the sinusoidal voltage waveform shall be within ± 10 electrical degrees of *B* (the peak of the open-circuit voltage waveform). The pulse direction shall be in phase with the negative half cycle of the supply voltage. The pulse application shall be to the centre eyelet terminal of the lamp base with the shell grounded.



Key

A pulse height as specified on the lamp data sheet

B $\sqrt{2}$ x test voltage (r.m.s.) as specified on the lamp data sheet

C 50 % of *A*

T_1 rise time as specified on the lamp data sheet

T_2 duration time of the pulse as specified on the lamp data sheet

Figure A.3 – Shape and parameters of the pulse used in North America

Annex B
(informative)
Diagrammatic data sheets for location of lamp dimensions

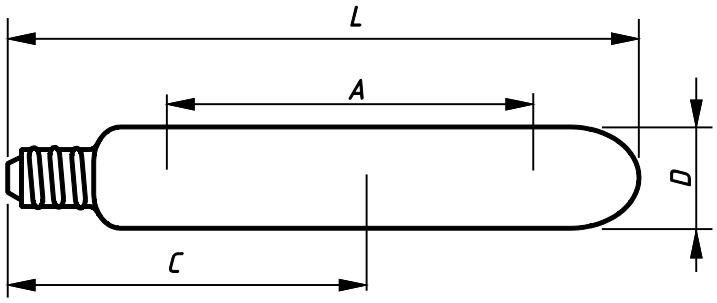


Figure B.1 – Tubular bulb lamp*

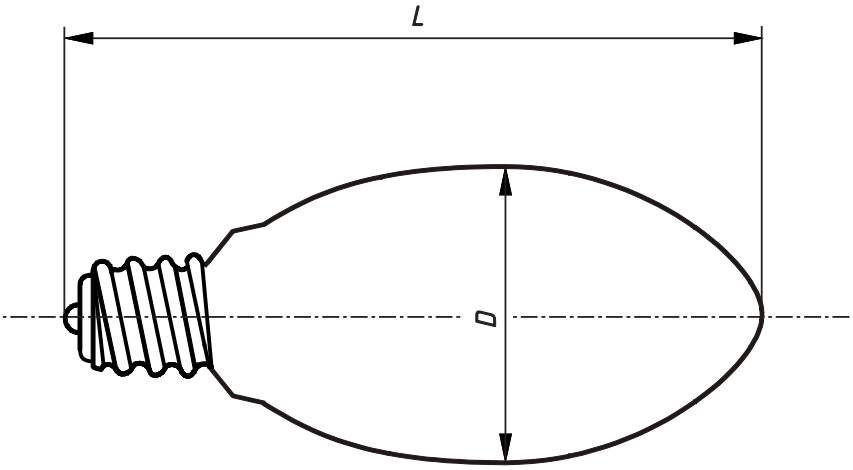


Figure B.2 – Elliptical bulb lamp*

Key
A arc length
C light centre length
D bulb diameter
L overall length

*For the caps, see IEC 60061-1, 7004-nn

cap	nn
E26/24	21A
E27	21
E39	24A
E40	24

Annex C
(normative)

Guidance for determining quadrilateral diagrams

C.1 General

In a lighting system employing high-pressure sodium (HPS) lamps, there are several variables that affect performance. In addition to normal production variations in both lamp voltage and ballast impedance, other factors to be accounted for are: line voltage variations, changes in lamp characteristics with time and a luminaire effect due to the reflection of radiant energy back to the arc tube. This dynamic system is more easily understood when presented in the form of a lamp parameter boundary picture, which includes all variables. This boundary picture, which is called a quadrilateral diagram, is a plot of lamp operating wattage vs. lamp operating voltage.

This annex defines certain technical terms, describes the basis for determining the various sides of a quadrilateral and gives an interpretation of the final diagram. It should be noted that some quadrilateral diagrams developed earlier might not be compatible with these guidelines.

C.2 Lamp characteristic curve

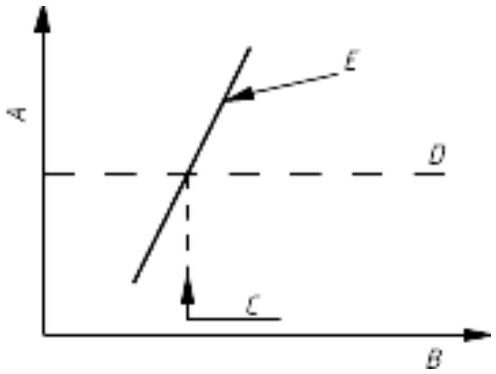
An HPS lamp exhibits substantial arc voltage changes with a wattage change during life. This can be contrasted to the mercury vapour lamp where lamp voltage remains relatively constant when lamp wattage changes. This relationship between lamp voltage (arc voltage) and wattage is due to the fact that the HPS arc tube contains an excess of sodium amalgam. During lamp operation the sodium and mercury are in the liquid amalgam phase and are located at a “cold spot” near one end of the arc tube. Only a small fraction of the sodium and mercury is actually in the vapour phase. The vapour pressure, and therefore the lamp voltage, depends on the cold spot temperature, which is a function of lamp wattage. The relationship between wattage and voltage is approximately linear in the region of interest around the nominal wattage. This nearly straight-line curve (shown in Figure C.1 which represents this relationship) is defined as the “lamp characteristic curve”.

NOTE Some North American lamps have unsaturated doses of mercury and for these lamps voltage is substantially independent of wattage and therefore does not increase over lamp life.

The lamp characteristic curve for a particular lamp may be obtained by varying the wattage, either by changing the line voltage or the ballast impedance over a range.

The point at which a lamp characteristic curve crosses the line of rated wattage defines the “characteristic voltage” of that lamp. A “design centre” lamp is a lamp whose characteristic voltage is equal to the specified rated voltage at lamp terminals.

A sample of lamps of the same wattage will have nearly parallel lamp characteristic curves as shown in Figure C.2. The slopes of these curves will be less steep for lamps of progressively higher characteristic voltages. As a lamp ages, its characteristic voltage rises.



Key

A lamp wattage (W); *B* lamp voltage (V); *C* characteristic voltage; *D* rated wattage; *E* lamp characteristic curve

Figure C.1 – Relationship of wattage and voltage of an HPS lamp

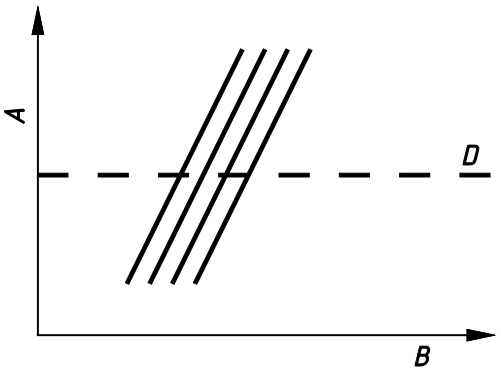
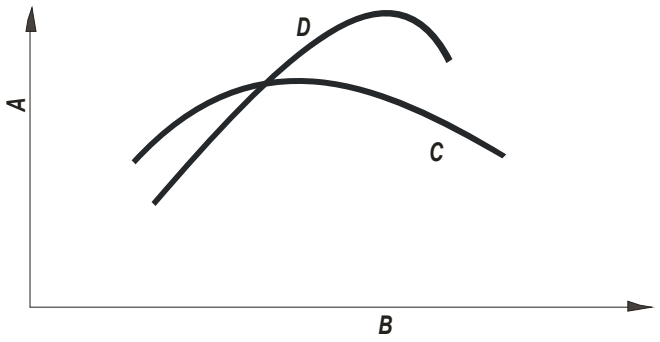


Figure C.2 – Lamp characteristic curves for several HPS lamps

C.3 Ballast characteristic curve

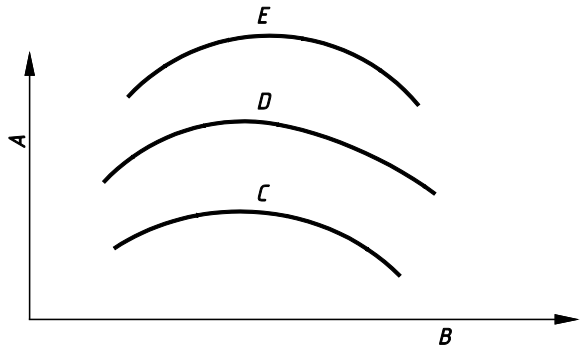
When an HPS lamp operates on a ballast connected to a constant input voltage, changes in the lamp's operating voltage and wattage follow the "ballast characteristic curve". Figure C.3 shows two typical ballast characteristic curves. These curves are obtained by measuring the wattage and voltage of a number of lamps with different characteristic voltages or by measuring a single lamp whose voltage is made to vary by externally causing the cold spot temperature of the arc tube to rise.

A family of ballast characteristic curves is generated when the supply voltage is varied. Figure C.4 shows this effect at rated supply voltage and at increased and reduced voltages.



Key
A lamp wattage (W)
B lamp voltage (V)
C reactor ballast
D regulator ballast

Figure C.3 – Typical ballast characteristic curves



Key
A lamp wattage (W)
B lamp voltage (V)
C reduced supply voltage
D rated supply voltage
E increased supply voltage

Figure C.4 – Typical lag or reactor ballast characteristic curves at different supply voltages

C.4 Maximum wattage limit

The top line of the quadrilateral diagram represents the maximum wattage limit of the HPS lamp. The maximum wattage line is determined by the maximum permissible operating

temperature of the arc tube. This maximum permissible wattage is defined as a value, which will result in reduced life if a lamp is operated at this value for more than approximately 25 % of the time. The maximum wattage line is usually placed approximately 20 % to 30 % above the rated wattage.

An additional guideline for the location of the maximum wattage line is that it should lie above the ballast characteristic curve produced by a reference ballast operating at an increased voltage (for example 105 % used in North America). The allowance above the peak of this reference ballast curve takes into account manufacturing and design tolerances for commercial ballasts.

The actual placement of this limit line in a quadrilateral diagram is then determined after detailed consideration of practical product requirements. Placement relative to the rated wattage varies by lamp type because the optimum wall loading of some arc tubes may be altered to accommodate other lamp design requirements.

C.5 Minimum wattage limit

The lower wattage limit line is set to ensure proper lamp operation in terms of:

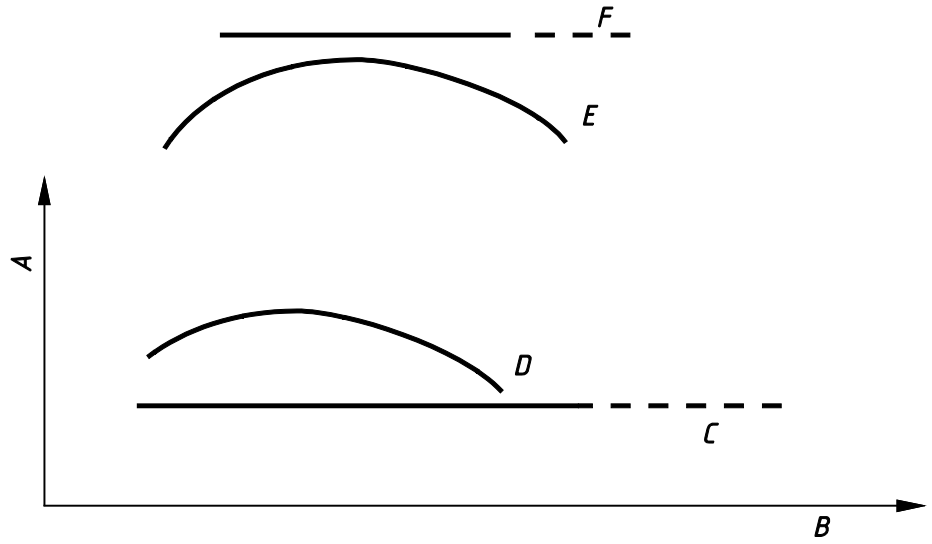
a) satisfactory lamp warm-up characteristics;

b) acceptable lamp operating stability;

c) acceptable system lumen output;

d) acceptable colour rendition and uniformity.

This limit line is placed approximately 20 % to 30 % below the rated wattage and shall be below the ballast characteristic curve of a reference ballast operating at a reduced voltage (for example 95 % used in North America. The allowance below this reference ballast curve takes into account manufacturing and design tolerances for commercial ballasts. The placement of this limit line in a quadrilateral diagram in this standard is then determined after detailed consideration of practical product requirements. Figure C.5 shows the maximum and minimum wattage lines and their relationship to the noted reference ballast characteristic curves.



Key

A lamp wattage (W)

B lamp voltage (V)

C minimum wattage

D reference ballast characteristic curve (at reduced supply voltage)

E ballast characteristic curve (at increased supply voltage)

F maximum wattage

Figure C.5 – Minimum and maximum wattage lines

C.6 Minimum voltage line

The minimum voltage line, the left-hand boundary of the quadrilateral, is that lamp characteristic curve of the lamp with the minimum acceptable voltage at lamp terminals. The agreed minimum lamp voltage for each lamp type is specified on the appropriate lamp data sheet. It lies to the left of the rated voltage and rated wattage point and establishes the left-hand side of the quadrilateral.

The characteristic curves of ballasts are not to intersect the minimum wattage line before crossing the minimum voltage line.

C.7 Maximum voltage line

The maximum voltage line defines the right-hand side of the quadrilateral diagram. It is determined by the following factors:

a) the highest acceptable characteristic voltage of a new lamp;

b) the rise in lamp voltage that takes place during life;

c) the increase in lamp voltage resulting from enclosure in a luminaire;

d) a locus of lamp drop-out voltages that occur on a reference ballast.

The maximum characteristic voltage is derived form the locus of drop-out voltage (details are under consideration). The drop-out characteristic voltage value is then reduced by an amount equal to 20 % of the rated lamp voltage and is plotted back along the rated wattage line. This termination point fixes the maximum characteristic voltage. From this point, a series of lamp voltage measurements are made to produce the maximum lamp characteristic curve.

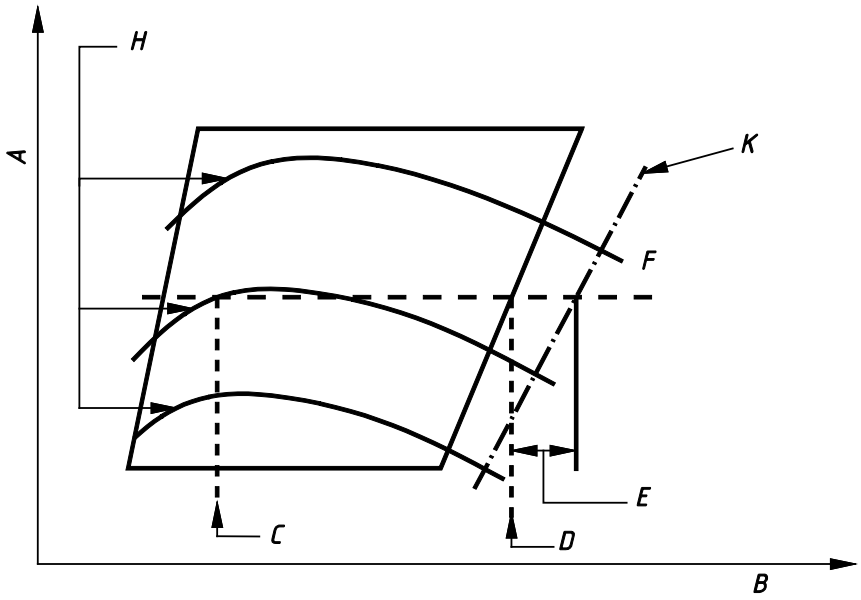
In ballast design, the maximum lamp voltage and wattage limits are closely related. Increasing the limit for maximum voltage necessitates an increase in the maximum wattage limit because some types of ballast have characteristic curves that can span a greater range of voltage only if a higher wattage is allowed.

C.8 Summary

C.8.1 Interpretation related to lamp and ballast

The finished diagram consists of maximum and minimum wattage lines, and minimum and maximum voltage lines as shown in Figure C.6. The diagram can be used as a system specification because it encompasses certain requirements for both lamp and ballast while including a luminaire effect. The quadrilateral for each wattage system provides ballast design information to operate lamps properly.

The final diagram is based on the operation of a lamp on a reference ballast with various tolerances and allowances as noted in the maximum and minimum wattage clauses. Nevertheless, the limits of lamp operation are related to underlying physical characteristics of the lamp and, therefore, are to be interpreted as relating to all types of commercial ballasts. It is apparent that the quadrilateral for a given system defines operational limits of any lamp operated on any ballast.



Key

A	lamp wattage (W)	*D*	maximum characteristic lamp voltage	*H*	reference ballast characteristic curves various supply voltages
B	lamp voltage (V)	*E*	20 % nominal lamp voltage		
C	rated lamp voltage	*F*	rated lamp wattage	*K*	locus of drop-out points

Figure C.6 – Finished quadrilateral relative to the reference ballast curves and drop-out locus

The completed quadrilateral describes qualifications for ballast design, which can be summarised as follows.

a) The ballast characteristic curve shall intersect both the lamp voltage limit lines and remain between the wattage limit lines throughout the life of a lamp.

b) The design of the ballast is such that under normal conditions the lamp always operates within the quadrilateral, not only at the rated supply voltage of the ballast, but also at the lowest and highest supply voltages for which the ballast is recommended.

NOTE Since a lag ballast is similar to a reference ballast, it cannot be expected to operate the system satisfactorily if the limits of the supply voltage variation exceed the values specified in this standard.

c) A preferred ballast characteristic curve is one, which permits the lamp to attain its maximum wattage at or before the maximum voltage line and then decreases substantially as the lamp voltage increases beyond this point. A relatively flat ballast characteristic curve located near the line of rated lamp wattage is preferable to one which rises and falls relatively steeply.

d) To avoid short lamp-life, instability and premature drop-out, the ballast should be capable of operating the lamp beyond the maximum voltage line at the right-hand side of the quadrilateral.

Although not defined by the quadrilateral, a lamp-ballast system shall also withstand an extinguishing voltage test. In such a test, the ballast shall maintain lamp operation when the mains voltage is suddenly dropped to 10 % below the ballast's rated value. This requirement is to be detailed in the lamp specification.

C.8.2 Interpretation related to luminaire design

The allowance of lamp voltage rise assigned to the luminaire effect is not readily visible on the finished quadrilateral. The permissible voltage rise value is listed in the individual lamp standard data sheet.

Annex D
(normative)

Measurement of voltage increase at lamp terminals for luminaire design

D.1 General

Two procedures have evolved for the measurement of this parameter, based on European and North American practices.

It is essential that the method to be used is identified and agreed by the lamp manufacturer prior to the commencement of the tests.

D.2 Method 1: used mainly in Europe

D.2.1 General conditions for tests

D.2.1.1 Lamp ageing and selection

Using ballasts complying with 9.3.2, lamps shall be aged for 100 h in the same operating position as that used in the luminaire to be tested.

After ageing, the lamps shall be measured at rated supply voltage using the appropriate reference ballast at an ambient temperature of 25 °C ± 5 °C.

A minimum of five lamps shall be selected for voltage increase test, and shall have a voltage at lamp terminals tying within the inclusive minimum and maximum values given on the relevant lamp data sheet.

D.2.1.2 Ballast used for voltage increase measurement

The ballast used for the measurement of lamp voltage increase shall be of the type supplied for use in the luminaire under test, and shall comply with the requirements of 9.3.2 of this standard.

The ballast used for the free air measurement and for the luminaire measurement shall be the same, and shall operate in both cases under the intended mounting conditions.

D.2.1.3 Supply voltage and frequency

The supply voltage and frequency during the stabilisation and measurement periods shall be the rated values of the ballast specified in D.2.1.2.

During stabilisation periods, the supply voltage shall be maintained constant within ± 1,0 %. However, during the measurement periods, the voltage shall be adjusted to within ± 0,5 % of the specified testing value.

At all times the frequency shall be maintained within ± 0,5 % of the rated value.

D.2.1.4 Instruments

The instruments used for the measurement of lamp voltage shall be of the true r.m.s. type and shall have an impedance of not less than 100 000 Ω. The same instruments shall be used throughout the test.

D.2.1.5 Lamp positioning

For the measurement of the lamp voltage in and out of the luminaire, the same lateral operating position and axial orientation shall be used. For this purpose, it is advisable to indicate the correct operating position with an appropriate mark.

For luminaires, which may be operated in more than one operating position, only one position need be checked. This operating position shall be that which is most generally used.

D.2.1.6 Minimised lamp disturbance

On each occasion when a lamp is switched off, it shall be left undisturbed for at least 60 min before being moved to another location.

D.2.2 Method of measurement

D.2.2.1 The lamp shall be operated in free air at an ambient temperature of 25 °C ± 5 °C, for a period of at least 60 min and until lamp stabilisation has been achieved.

Stabilisation is determined when, by monitoring the electrical characteristics of the lamp at 10 min to 15 min intervals, three successive measurements show a difference of 1 % or less in lamp voltage.

D.2.2.2 After the cool-down period, the lamp shall be transferred to the luminaire.

D.2.2.3 In an ambient temperature of 25 °C ± 5 °C the lamp shall be operated in the luminaire for a period of at least 60 min and until lamp stabilisation has been achieved.

Stabilisation is determined in an identical way with the method specified in D.2.2.1.

D.2.2.4 The final value of lamp voltage recorded in D.2.2.1 shall be subtracted from the final value of lamp voltage recorded in D.2.2.3. The resultant difference shall be taken as the voltage increase of the individual lamp and it shall be recorded.

D.2.2.5 The procedure given in D.2.2.1 to D.2.2.4 shall be repeated for all of the lamps used for the test.

D.2.3 Interpretation of lamp voltage measurements

D.2.3.1 From the recorded values of voltage increase for each individual lamp as specified in D.2.2.4, the highest value of voltage increase and the lowest value of voltage increase shall be determined.

D.2.3.2 The average voltage increase shall be calculated, omitting from the calculation the highest and lowest lamp values determined in D.2.3.1.

This value of average voltage increase shall be used for comparison with the value specified on the relevant lamp data sheet.

D.3 Method 2: used mainly in North America

D.3.1 General conditions for tests

D.3.1.1 Lamp selection

A reference lamp is selected from any sample of seasoned lamps that have been measured on the appropriate reference ballast. The reference lamp is one that yields measured electrical characteristics (voltage, wattage, and current values) within ± 2 % of the nominal values given on the relevant lamp data sheet. Only one reference lamp is required for a particular wattage class.

D.3.1.2 Test ballast

The ballast used for the measurement of the lamp voltage increase shall be a reference ballast as specified for the type of lamp under test.

D.3.1.3 Supply voltage and frequency

The supply voltage and frequency during the stabilisation and measurement periods shall be equal to the rated value of the reference ballast specified in D.3.1.2. During the stabilisation period, the supply voltage shall by maintained constant within ± 1 %. However, during the measurement period, the voltage shall be adjusted within ± 0,5 % of the specified testing value.

D.3.1.4 Instruments

The instruments used for the measurements shall comply with D.2.1.4.

D.3.2 Method of measurement

D.3.2.1 The reference lamp shall be operated, on the reference ballast of D.3.1.2, in free air at an ambient temperature of 25 °C ± 5 °C for a period of at least 60 min and until lamp stabilisation has been achieved.

Stabilisation is as defined in D.2.2.1. The presence in the test area of highly reflective surfaces and sources of radiation should be avoided. When the bare lamp reaches a stable operating condition, the lamp voltage shall be recorded.

D.3.2.2 The lamp shall be permitted to cool to essentially ambient temperature for a minimum of 1 h before being transferred to the test luminaire. The luminaire shall be at a stabilised temperature of 25 °C ± 5 °C.

D.3.2.3 The lamp shall be operated in the test luminaire for a period of at least 60 min and until lamp stabilisation has been achieved. Operation shall occur on the same reference ballast specified in D.3.1.2, which shall be located outside the test luminaire. Stabilisation is determined in an identical way with the method specified in D.2.2.1.

D.3.2.4 The final value of lamp voltage recorded during the stabilisation check of D.3.2.3 shall be recorded.

D.3.2.5 The lamp voltage increase for the luminaire under test is determined by calculating the recorded stabilised lamp voltage of D.3.2.4 minus the stabilised bare lamp voltage of D.3.2.1. This value of voltage increase shall be used for comparison with the value specified on the relevant lamp data sheet.

Annex E
(informative)

HPS lamp drop-out voltage measurement procedure

E.1 General and objective

The following procedure may be used to measure drop-out voltages of high-pressure sodium (HPS) lamps. Experience has shown that this kind of measurement is difficult to make and the consistency of results is affected by several factors.

Speculation has been made that the wide variety of results reported in the past is due to variations in experimental set-up and procedure. It is anticipated that the use of one common method will permit the comparison of data from different sources. The procedure contained herein is recommended as that common method.

The purpose of the subject procedure is to obtain data from lamps that will help to establish the “maximum voltage” line at the right-hand side of a quadrilateral diagram.

E.2 Theory

Operating limits of an HPS lamp are defined by a quadrilateral diagram, such as Figure E.2.

Typically, the voltage of an HPS lamp increases through life. At some point in time a critical voltage is reached where the ballast will not be able to sustain the lamp. This voltage is called the drop-out voltage and it is a function of both lamp and ballast operating characteristics. In order to avoid differences in ballast operating characteristics due to design and manufacturing variations, a reference ballast is used in this procedure to determine drop-out voltage of a test lamp.

This procedure for measuring drop-out points involves operating a test lamp on a reference ballast and artificially raising the lamp’s voltage until the drop-out point is reached. The lamp voltage is related to the amalgam temperature and can be increased by raising the temperature of the amalgam cold spot area. This heating can be accomplished by using either an external source of radiant heat or by redirecting some of the test lamp’s radiation back onto itself. A metal cylinder lowered over the lamp or other artificial methods provide a convenient and controllable means of reflecting energy from the lamp back onto the arc tube within the lamp. Clear lamps are recommended for this test work. Coated lamps diffuse this radiant energy and complicate the experiment. Therefore, they should be avoided.

In some lamp designs, a reservoir, external to the arc tube, serves as the amalgam cold spot. In lamps without an external reservoir, one or both ends of the arc tube can serve as the cold spot. When the end of the arc tube that has the cold spot is artificially heated, an equivalent or greater amount of heat must be applied to the opposite end of the arc tube. This can be accomplished artificially by placing a metal cylinder or aluminium foil over the “opposite” end of the lamp.

As the cold spot end is heated by artificial means, the lamp’s voltage and wattage rise for the particular supply being used. They can be recorded as they follow the ballast curve. A drop-out point can be obtained from these data. See Figure E.3, as an example where voltage-wattage points were made at various supply voltages and the drop-out points identified from the discontinuity of plot direction.

E.3 Methods of artificial heating

E.3.1 General

There are four commonly used methods of artificially heating the lamp’s arc tube. These are listed below in order of preference.

E.3.2 Metal sleeve

The inside diameter of the metal sleeve should be only slightly larger than the outside diameter of the test lamp. Aluminium foil can be used to cover the inside surface of the sleeve to increase its reflectivity. An adjustable, mechanical drive to control sleeve movement is advantageous but not absolutely necessary.

After the test lamp has been started and reached its normal operation point, the sleeve is to be positioned over the lamp from the end opposite to the cold spot. The rate of increasing coverage of the lamp is limited by “equilibrium” (see Clause E.4 “Description of equilibrium”).

As the expected drop-out point is approached, the coverage rate shall be slowed down.

E.3.3 Metal sleeve and projection lamp

When method in E.3.2 does not drive the test lamp to drop-out, externally generated heat shall be applied also. An incandescent, ellipsoidal-mirror-type projection lamp should be used. It is necessary to be able to focus the projection lamp’s light output on the test lamp’s cold spot. The projection lamp is to be controlled by means of an adjustable autotransformer.

In this method, the metal sleeve is stopped at a position where the cold spot end is still exposed. Then the (pre-aimed) projection lamp’s output is slowly increased to heat up the cold spot.

E.3.4 Foil and projection lamp method

A piece of pre-shaped aluminium foil is fitted over the lamp end opposite to the cold spot. The foil should extend only about ½ the length of the arc tube. The lamp is started with this shaped foil section removed. After reaching the normal lamp operating point, the foil is placed on the lamp. After the lamp reaches another stable point, the external heat is applied to the cold spot from the projection lamp.

E.3.5 The two projection lamp method

In this method, the output of one projection lamp is focused on the end of the arc tube opposite the cold spot, the second lamp is aimed at the cold spot end. After the test lamp is started and reaches its normal operating point, the first projection lamp is turned on and its output increased slowly. As the expected drop-out is neared, the second lamp is turned on and its output increased slowly.

E.4 Description of equilibrium

The lamp voltage must be increased at a low enough rate to keep the lamp-ballast system near “equilibrium”. If the lamp voltage is increased at too high a rate, an incorrect ballast curve and drop-out point will be recorded (see Figure E.4).

Two tests can be used to determine if the lamp-ballast system is near equilibrium.

a) After the lamp voltage has been raised by an amount of 5 V to10 V, the cylinder position (or external light source intensity) should be fixed and the lamp voltage-wattage monitored. If the system is in equilibrium, the operating point will either remain constant or will move along the ballast curve. If the voltage has been raised at too high a rate, the lamp wattage will increase after the cylinder position is fixed and the operating point will then move up to the true ballast curve (see Figure E.5).
b) The second test is to remove the cylinder after the lamp voltage has been raised 10 V or more. The true ballast curve will then be retraced as the lamp returns to its normal operating voltage. If the two curves overlap, the ballast-lamp system is in equilibrium. This is the easier of the two tests to use.

E.5 Equipment and test lamps (see also Notes 1 and 2)

Equipment is as follows:

– voltage regulator or line conditioner;

– reference ballast;
– instrumentation, as necessary, to record true r.m.s. voltage and power;
– lampholder and wiring;
– aluminium foil;
– cylindrical, metal sleeve (with mechanical control of position as an option);
– Tesla coil or external ignitor;
– incandescent, ellipsoidal reflector projection lamp and voltage control;
– test lamps, clear bulb, aged 100 h.

NOTE 1 Equipment

The supply voltage and frequency should be maintained constant within ±0,5 %. However, during actual measurements the voltage should be adjusted to within ±0,2 % of the test value. The total harmonic content of the supply voltage should not exceed 3 %, the harmonic content being defined as the root-mean-square (r.m.s.) summation of the individual harmonic components, using the fundamental as 100 %. This implies that the supply source should have sufficient power and that the supply circuit should have a sufficiently low-impedance compared with the ballast impedance.

Various kinds of digital voltmeters and wattmeters with a d.c. analog output are commercially available. Other true r.m.s. voltage and wattage convertors can be used provided that the output is checked for linearity and that the impedance limitations for HPS lamp measurements are adhered to.

As far as the measurement of the rise of the lamp voltage is concerned, there is an additional requirement that the speed of response of the measuring system should be at least equal to the rate of change in voltage and wattage. Devices with a very long settling time would not be suitable.

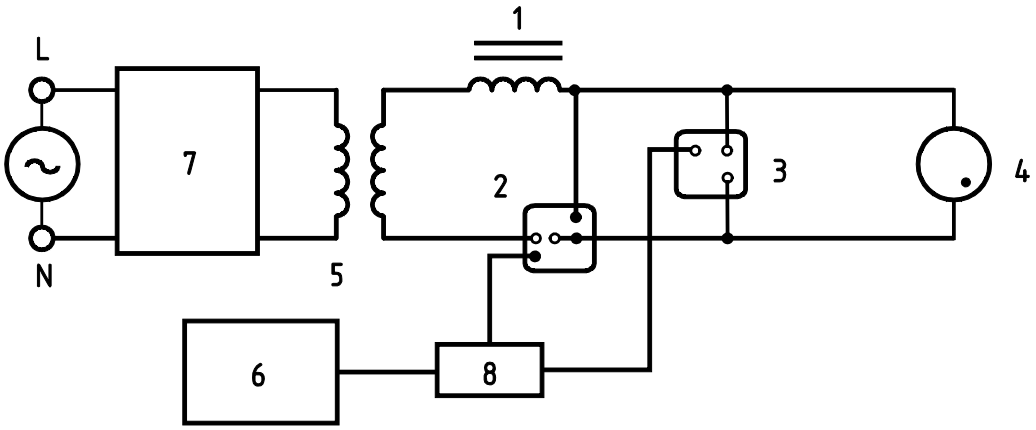
Use of a Tesla coil to start test lamps is the preferred method. An external ignitor is satisfactory, but its use involves special cautionary steps to avoid damage to other equipment.

NOTE 2 Test lamp

New test lamps should have 100 h seasoning at normal conditions before use. Lamps with clear bulbs should be used.

A particular test lamp should not be re-tested in a new operating position without first going through a re-stabilising period.

Stabilisation is determined by monitoring a lamp's electrical characteristics after 1 h of operation and at 10 min to 15 min intervals thereafter until a change of 1 % or less is observed in three successive measurements. If a lamp is warmed up on one ballast and then transferred without extinguishing it to a reference ballast, an additional period of operation is usually necessary to bring the lamp into equilibrium.



Key

1 reference ballast
2 wattmeter
3 voltmeter
4 HPS lamp
5 isolation transformer
6 recorder, plotter, computer, etc.
7 regulator
8 interface

Figure E.1 – Example of test circuit

E.6 Procedure

Procedure is as follows.

a) Assemble the necessary equipment and connect the components in the test circuit (see Figure E.1).

b) Pre-set position of metal sleeve, foil, and/or projection lamp(s) as required, according to the method of artificial heating to be used.

c) Energise the test circuit and apply nominal voltage to the reference ballast. Commence recording and let the test lamp reach its normal operating point before introducing artificial heating.

   Caution:

   Disconnect all instruments during starting to protect against breakdown of electronic components due to the high voltage pulse.

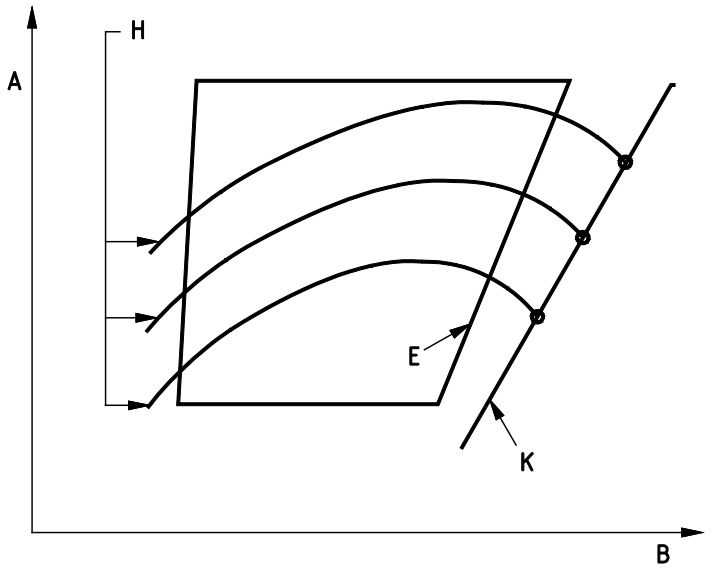
   If an ignitor is used, disconnect it after starting so that it does not attempt a restart after the drop-out point. This could damage the meter.

d) Start the appropriate means of artificial heating as required. Watch for a steady rise in lamp voltage, maintain equilibrium. If the first method does not drive the lamp voltage rise up high enough to cause drop-out, use an alternative method.

e) After the test lamp has been allowed to cool, or using a new lamp each time, repeat step c) and d) for two other supply voltage settings as required in 9.3.2.

E.7 Report

For each particular lamp type, three voltage-wattage drop-out points will have been determined at the completion of the experimental procedure. There is a separate point for each different input voltage run. These three data points should be reported so that a “locus of drop-out voltages” as shown in Figure E.2 can be drawn.



Key

A lamp wattage (W)

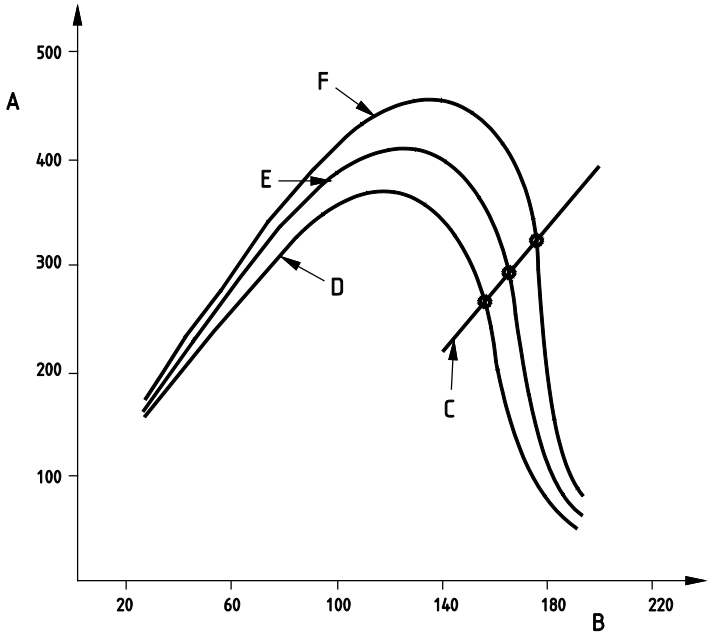
B lamp voltage (V)

E maximum voltage line

H reference ballast characteristics curves at lower, rated and upper supply voltages as specified in 9.3.2

K locus of drop-out voltages

Figure E.2 – Typical quadrilateral diagram showing drop-out points



Key

A lamp wattage (W)

B lamp voltage (V)

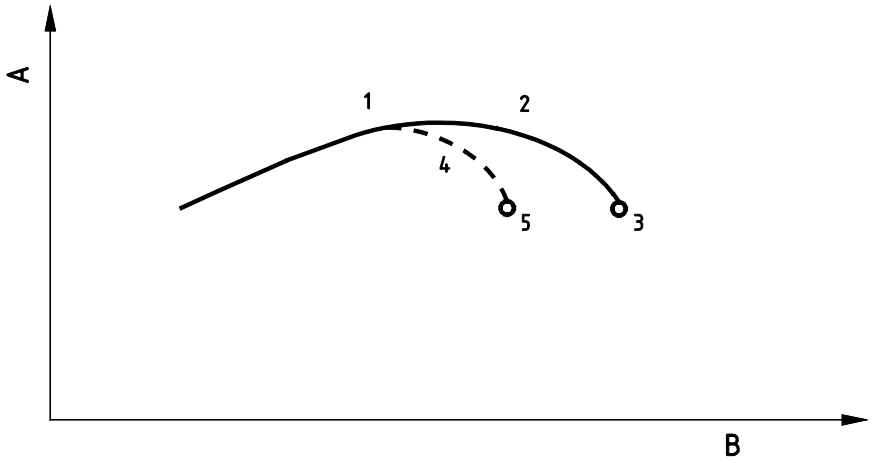
C locus of drop-out points

D lower voltage

E rated voltage

F upper voltage

Figure E.3 – Example plot of 400 W HPS lamp ballast curves showing drop-out points



Key

A lamp wattage (W)

B lamp voltage (V)

1 equilibrium open luminaire operating point

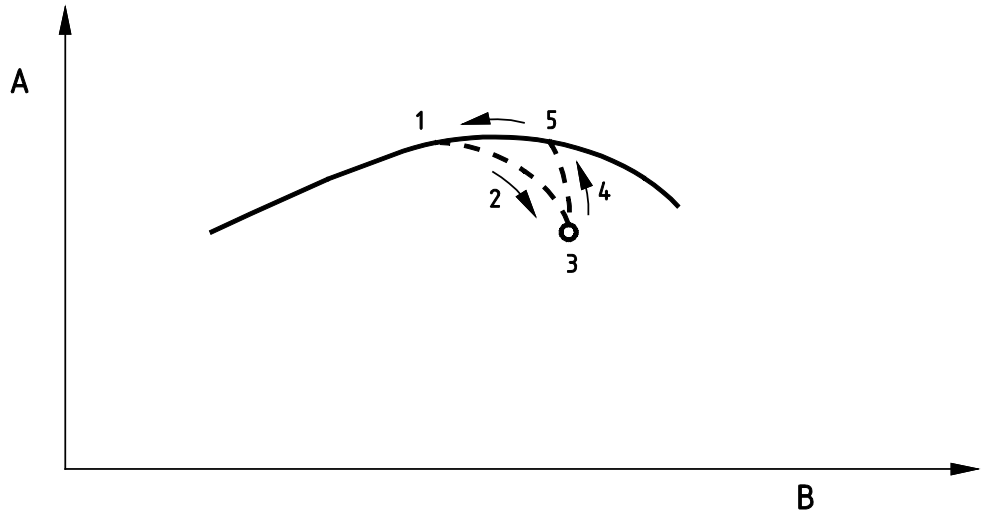
2 true ballast curve – for a given ballast and supply voltage

3 true ballast drop-out point

4 lamp voltage raised at too high a rate. Lamp-ballast not in equilibrium

5 incorrect drop-out point

Figure E.4 – Incorrect drop-out point measurement due to raising lamp voltage at too high a rate



Key

A lamp wattage (W)

B lamp voltage (V)

1 equilibrium open luminaire operating point

2 lamp voltage raised at too high a rate

3 lamp voltage allowed to equilibrate

4 operating point returns to true ballast curve

5 remove cylinder, operating point returns to 1 along true ballast curve

Figure E.5 – Test for lamp-ballast equilibrium

Annex F
(normative)

Fixed settings of the ignition device (see 8.2.1) and requirements for ignition

Table F.1 gives the fixed settings of the ingition device.

Table F.1 – Fixed settings of the ignition device (see 8.2.1)

Capacitance between device and lamp* pF	Max.	15
Starting pulse characteristics		
Waveshape		rectangular
Direction		positive
* The device can produce a quick rise time. However, the rise time is a function of the capacitance of the components needed between device and lamp. Therefore, this capacitance has to be restricted.		

The above settings and requirements shall be maintained for all types of high pressure sodium vapour lamps, except North American types.

Annex G
(normative)

Method of measuring electrical and photometrical characteristics

G.1 General

Lamps shall be tested in a circuit as shown in Figure G.1, at an ambient temperature of between 20 °C and 30 °C, using a nominal 50 Hz or 60 Hz supply as appropriate.

Lamps shall be operated in free air or as specified on the relevant lamp data sheet.

Lamps shall be operated in horizontal test position unless otherwise specified by the lamp manufacturer.

NOTE 1 North American practice is base-up unless otherwise restricted.

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. The phase of the supply and the pulse voltage is applied to the eyelet terminal.

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 ±5 % and the frequency by not more than ±1 Hz.

NOTE 2 The allowed tolerances are chosen to avoid the necessity of having a stabilised voltage and to permit the use of a normal mains supply.

G.2 Supply

The supply voltage V_1 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. 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 %.

NOTE 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.

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.

G.3 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 3 % 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 2 % of the rated lamp voltage.

G.4 Measurement

When measuring lamp voltage V_2, 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 V_2 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.

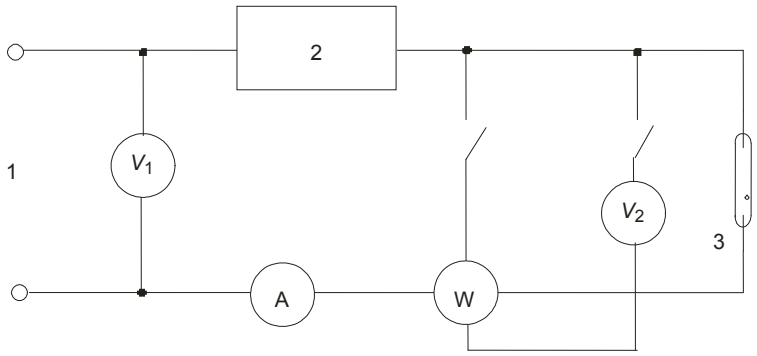
When measuring the luminous flux, the lamp voltmeter V_2 circuit and the voltage measuring circuit of the wattmeter shall be open and the ammeter and wattmeter current measuring circuit shall be short-circuited, if necessary.

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 cases 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 G.1 – Circuit diagram for measurement of lamp characteristics

Annex H
(normative)

Method of test for lumen maintenance and life

H.1 General

The luminous flux at a given time in the life of a lamp shall be measured as specified in Annex G.

During the life testing, lamps shall be operated as follows.

Lamps shall be operated in free air at an ambient temperature of between 15 °C and 50 °C. Excessive draughts shall be avoided and the lamps shall not be subject to extreme vibration and shock.

Lamps shall be operated in horizontal test position unless otherwise specified by the lamp manufacturer.

NOTE North American practice is base-up unless otherwise restricted.

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. The phase of the supply and the pulse voltage is applied to the eyelet terminal.

Lamps shall be switched off for 1 h after each 11 h of operation.

H.2 Lamps for operation on 50 Hz and 60 Hz

The ballast used shall comply with the requirements of IEC 60923.

NOTE 1 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.

NOTE 2 In North America, ballasts containing series capacitors are commonly used for aging lamps to determine lumen maintenance and life.

The type of ignitor to be used shall comply with the requirements of IEC 61347-2-1.

NOTE 3 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 of the ballast used.

Annex I
(informative)

Maximum lamp outlines

I.1 Advice for use of maximum lamp outlines

Maximum lamp outlines are provided for the guidance of designers of luminaires and are based on a maximum sized lamp inclusive of 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.

I.2 List of data sheets for maximum lamp outlines

Table I.1 gives a list of data sheets for maximum lamp outlines.

Table I.1 – List of data sheets for maximum lamp outlines

IEC 60662-IEC-	Nominal wattage W	Cap	Bulb
-	50	E27	Tubular
-	50	E27	Elliptical
-	70	E27	Tubular
-	70	E27	Elliptical
-	70	E26/24	Elliptical
-	100	E40	Tubular
-	100	E39-E40	Elliptical
-	150	E40	Tublar
-	150	E39-E40	Elliptical
I 150 01	150	E39	Elliptical
I 250 01	250	E40	Tubular
I 250 02	250 or 400	E39	Tubular
I 250 03	150 and 250	E39/45	Tubular
I 250 04	250	E39-E40	Elliptical
I 400 01	400	E39/45	Tubular
I 400 02	400	E39	Tubular
I 400 03*	400	E40	Tubular
I 400 04	400	E39-E40	Elliptical
-	600	E40	Tubular
-	1 000	E40	Tubular
-	1 000	E40	Elliptical
-	1 000	E39	Tubular

*Drawing under consideration

I.3 Data sheets for maximum lamp outlines

The following pages contain the data sheets for maximum lamp outlines.

HIGH-PRESSURE SODIUM VAPOUR LAMP
MAXIMUM LAMP OUTLINES

Dimensions for distances in millimetres

Table I.2 – Dimensional values for outlines of E27 and E40 capped lamps

Wattage (W)	50	50	70	70	100	100	150	150	250	250	400	400	1000	1000
Bulb**	T	E	T	E	T	E	T	E	T	E	T	E	T	E
Cap	E27	E27	E27	E27	E40	E40	E40	E40	E40	E40	E40	E40	E40	E40
A									39,5	39,5	39,5	39,5		
∅D									74	104	*	140		
E										8		16		
H									34	34	*	34		
L									261	228	292	292		
∅N									62	58	*	66		
R										41		51		
α									45°	45°	45°	45°		

* under consideration

** T: tubular; E: elliptical

Key (as in IEC 61126)

A: cap width constant
∅D: maximum bulb diameter
E: offset of radius vector R1 from lamp axis
H: cap height constant, relative to baseline
L: maximum overall length
∅N: diameter at intersection of angle α with linear part
R: radius vector for the upper part of the (elliptical) bulb
α: gauge upper angle

HIGH-PRESSURE SODIUM VAPOUR LAMP

MAXIMUM LAMP OUTLINES

Dimensions for distances in millimetres

Table I.3 – Dimensional values for outlines of E39 and E39/45 capped lamps

Wattage (W)	100	150	150*	250**	250*	250	400**	400*	400	1000
Bulb***	E	E	T	T	T	E	T	T	E	E
Cap	E39	E39	E39/45	E39	E39/45	E39	E39	E39/45	E39	
A			39,6	39,5	39,6	39,5	39,5	39,6	39,5	
∅D			78	76,0	78	104	76,0	82	141,2	
E				13,3		8	13,3		16	
H			44	40,9	44	34	40,9	44	34	
L			250	248,0	250	228	248,0	295	292	
∅N			58	49,6	58	58	49,6	58	66	
R						41			51	
α			45°	56°	45°	45°	56°	45°	45°	

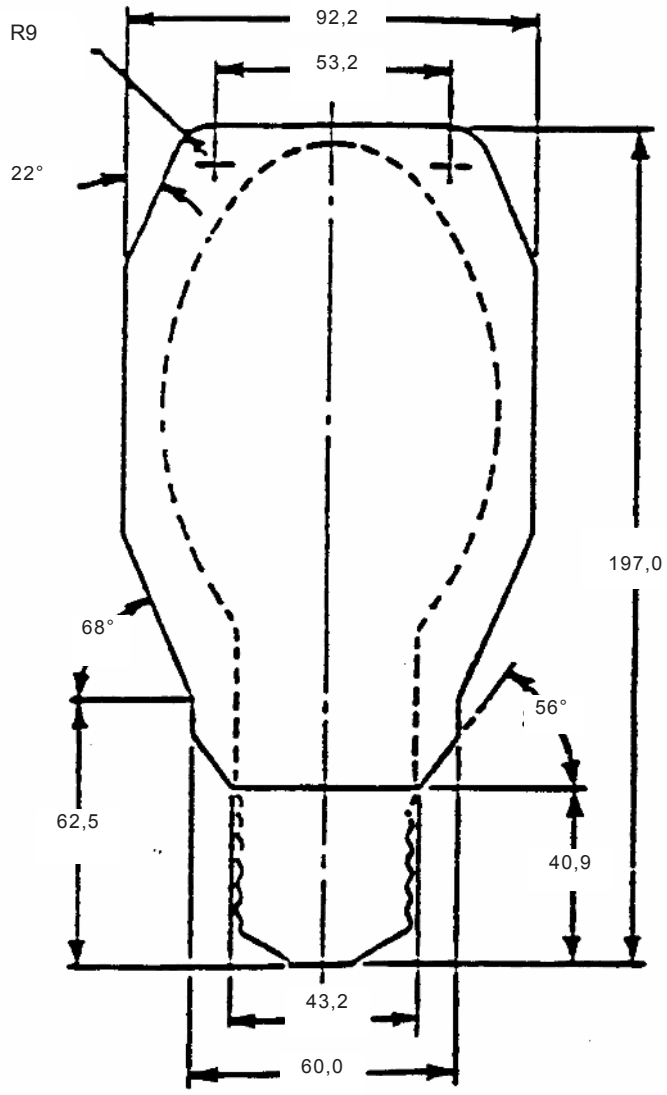
* Practice in Japan; apex point 24,5, bulb T50, angular displacement 3°
** Practice in North America, minimum overall length 238
*** T: tubular; E: elliptical

Key (as in IEC 61126)

A: cap width constant
∅D: maximum bulb diameter
E: offset of radius vector R1 from lamp axis
H: cap height constant, relative to baseline
L: maximum overall length
∅N: diameter at intersection of angle α with linear part
R: radius vector for the upper part of the (elliptical) bulb
α: gauge upper angle

HIGH-PRESSURE SODIUM VAPOUR LAMP
MAXIMUM LAMP OUTLINES

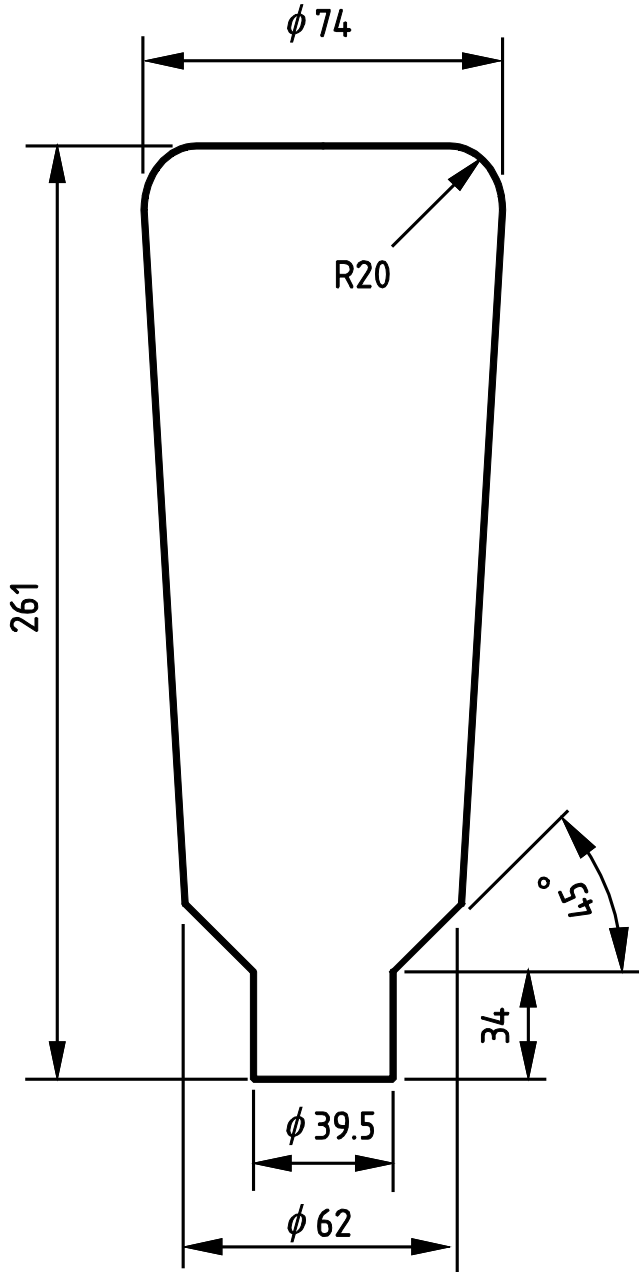
Dimensions for distances in millimetres



15001: 150 W, 55 V, elliptical, cap E39

HIGH-PRESSURE SODIUM VAPOUR LAMP
MAXIMUM LAMP OUTLINES

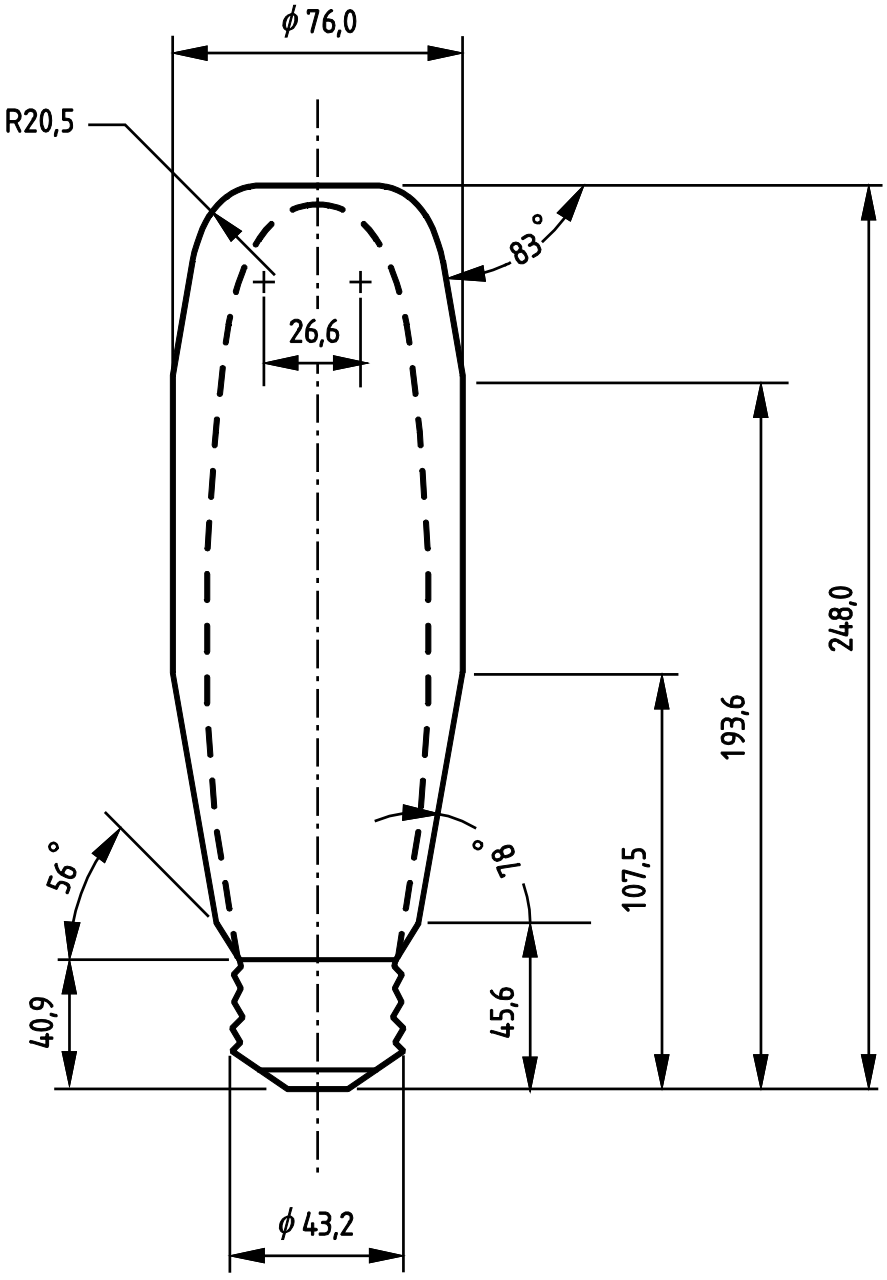
Dimensions for distances in millimetres



25001: 250 W, tubular, cap E40

HIGH-PRESSURE SODIUM VAPOUR LAMP
MAXIMUM LAMP OUTLINES

Dimensions for distances in millimetres

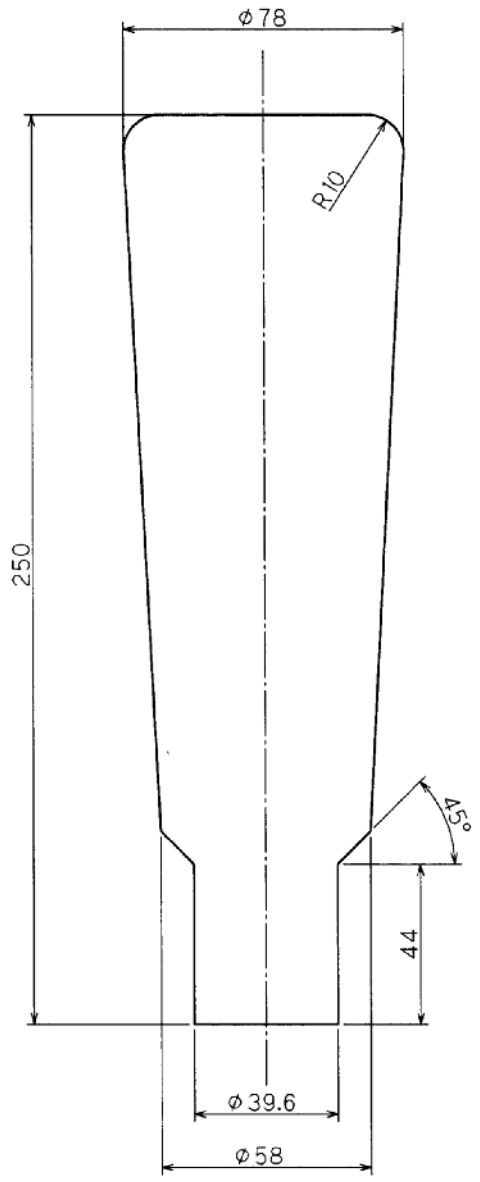


25002: 250 W or 400 W, tubular, cap E39

American practice

HIGH-PRESSURE SODIUM VAPOUR LAMP
MAXIMUM LAMP OUTLINES

Dimensions for distances in millimetres

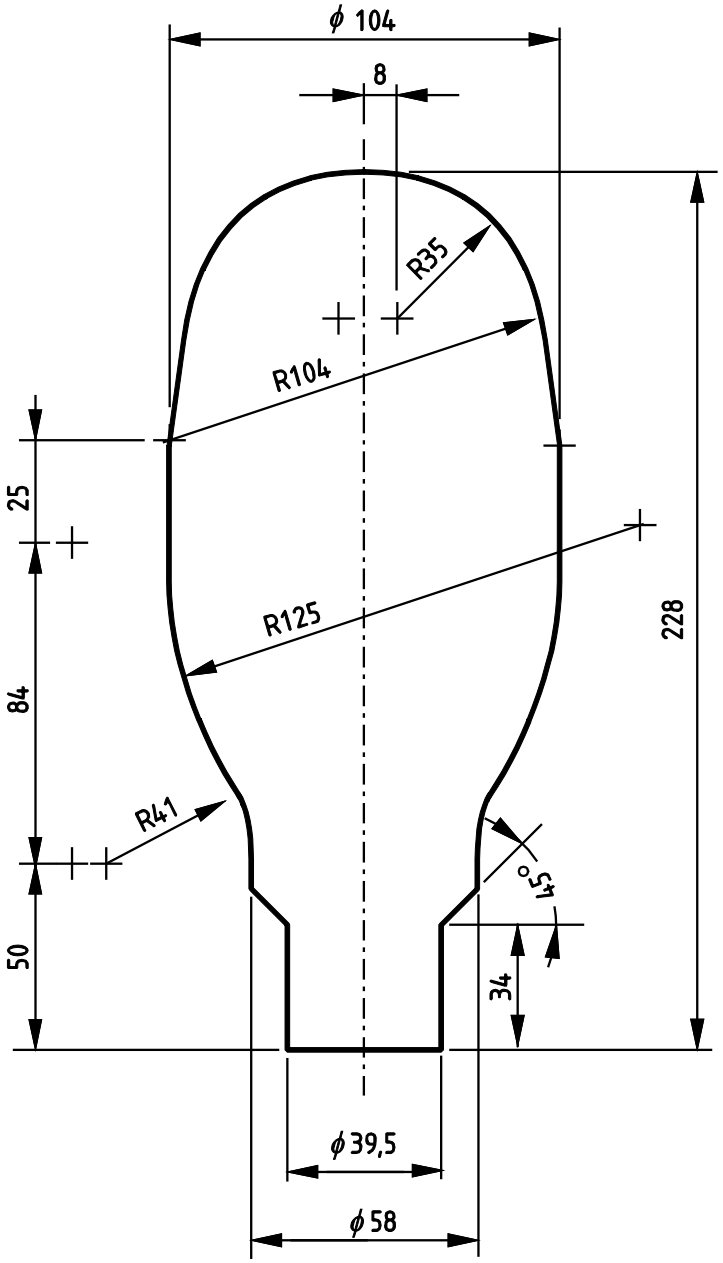


25003: 150 W, 250 W, tubular, cap E 39/45

Japanese practice

HIGH-PRESSURE SODIUM VAPOUR LAMP
MAXIMUM LAMP OUTLINES

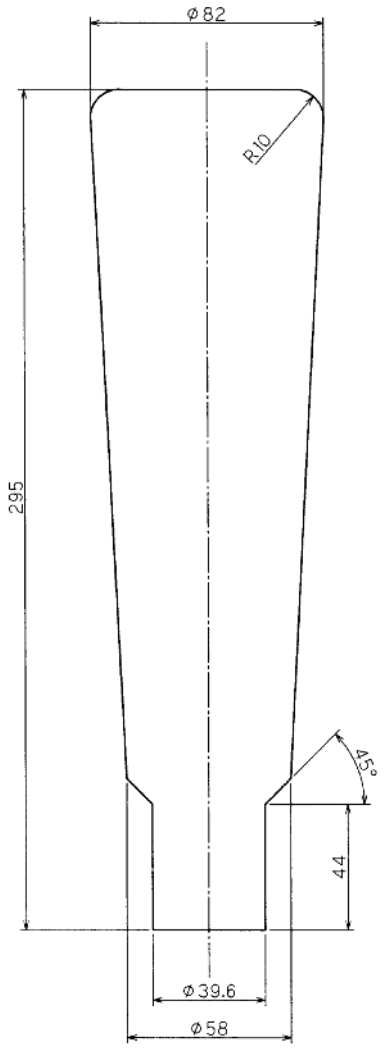
Dimensions for distances in millimetres



25004: 250 W, elliptical, cap E39-E40

HIGH-PRESSURE SODIUM VAPOUR LAMP
MAXIMUM LAMP OUTLINES

Dimensions for distances in millimetres

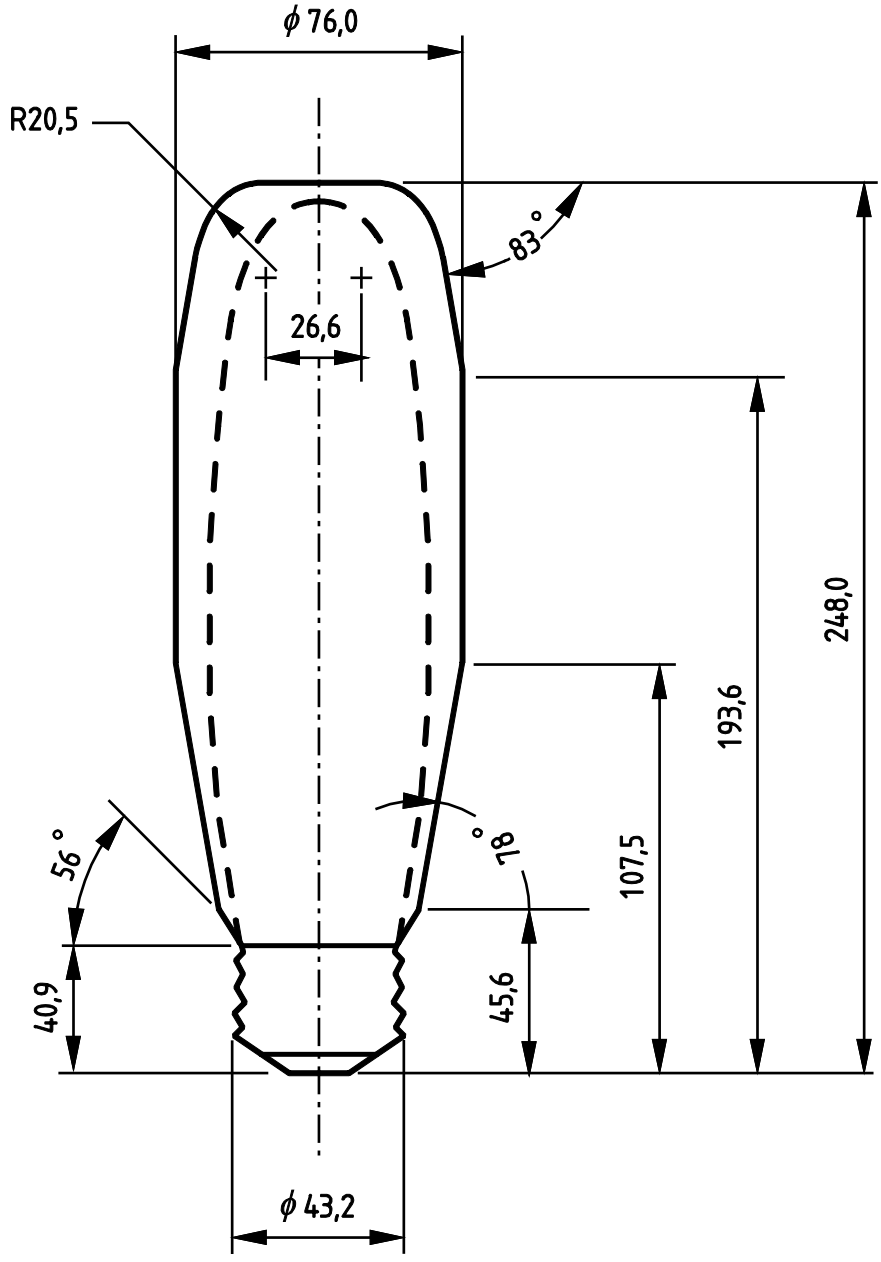


40001: 400 W, tubular, cap E39/45

Japanese practice

HIGH-PRESSURE SODIUM VAPOUR LAMP
MAXIMUM LAMP OUTLINES

Dimensions for distances in millimetres



40002: 400 W, tubular, cap E39

American practice

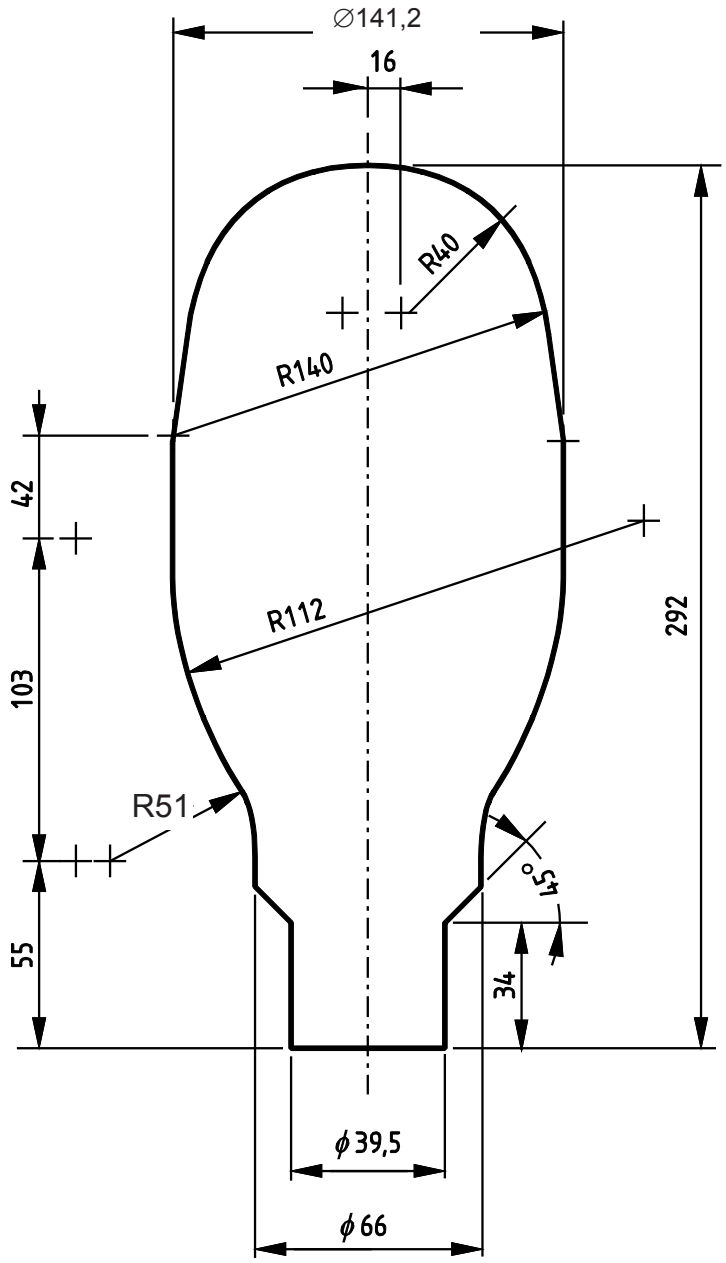
HIGH-PRESSURE SODIUM VAPOUR LAMP
MAXIMUM LAMP OUTLINES

Dimensions for distances in millimetres

40003: 400 W, tubular, cap E40

HIGH-PRESSURE SODIUM VAPOUR LAMP
MAXIMUM LAMP OUTLINES

Dimensions for distances in millimetres



40004: 400 W, elliptical, cap E39-E40

Annex J
(normative)

Lamp data sheets

J.1 List of specific lamp types represented by a data sheet

Sheet No. 60662-IEC-	Nominal wattage (W)	Voltage range	Method of starting	Cap	Bulb	Remarks
0550	50	HV	Internal or external	E27	Elliptical - clear or diffuse coating	
0555	50	HV	External	E27	Tubular - clear	
0770	70	HV	Internal or external	E27	Elliptical - clear or diffuse coating	
0775	70	HV	External	E27	Tubular - clear	
0785	70	LV	External	E26/24	Elliptical - clear or diffuse coating	
1100	100	HV	External	E40	Elliptical - diffuse coating	
1105	100	LV	External	E39	Elliptical - clear or diffuse coating	
1110	100	HV	External	E40	Tubular - clear	
2150	150	HV	Internal or external	E40	Tubular - clear	
2155	150	HV	External	E39	Tubular - clear	
2160	150	HV	Internal or external	E40	Elliptical - diffuse coating	
2165	150	HV	Internal or external	E39	Elliptical - diffuse coating	
2170	150	LV	External	E39	Elliptical - clear	
2200	150	HV	External	E40	Tubular - clear	Colour improved
2210	150	HV	External	E40	Elliptical - diffuse coating	Colour improved
2215	150	HV	External	E39	Elliptical - diffuse coating	Colour improved
2300	150	HV	Internal	E39	Elliptical - clear or diffuse coating	High R_a
3250	250	HV	Internal or external	E40	Tubular - clear	
3255	250	HV	Internal or external	E39	Tubular - clear	
3260	250	HV	External	E39	Tubular - clear	
3265	250	HV	Internal or external	E40	Elliptical - diffuse coating	
3270	250	HV	Internal or external	E39	Elliptical - diffuse coating	
3300	250	HV	External	E40	Tubular - clear	Colour improved
3305	250	HV	External	E39	Tubular - clear	Colour improved
3310	250	HV	External	E40	Elliptical - diffuse coating	Colour improved
3315	250	HV	External	E39	Elliptical - diffuse coating	Colour improved
3400	250	HV	Internal	E39	Elliptical - clear or diffuse coating	High R_a
3500	250	HV	External	E40	Tubular - clear	High efficacy
3505	250	HV	External	E40	Elliptical - diffuse coating	High efficacy
4400	400	HV	Internal or external	E40	Tubular - clear	
4405	400	HV	Internal or external	E39	Tubular - clear	
4410	400	HV	External	E39	Tubular - clear	
4415	400	HV	Internal or external	E40	Elliptical - diffuse coating	
4420	400	HV	Internal or external	E39	Elliptical - diffuse coating	
4500	400	HV	External	E40	Tubular - clear	Colour improved
4505	400	HV	External	E39	Tubular - clear	Colour improved
4510	400	HV	External	E40	Elliptical - diffuse coating	Colour improved
4515	400	HV	External	E39	Elliptical - diffuse coating	Colour improved
4600	400	HV	Internal	E39	Elliptical - clear or diffuse coating	High R_a
4700	400	HV	External	E40	Tubular - clear	High efficacy
4705	400	HV	External	E40	Elliptical - diffuse coating	High efficacy
6000	600	HV	External	E40	Tubular - clear	
9000	1 000	EHV		E39	Tubular - clear	
9005	1 000	HV	External	E40	Tubular - clear	
9010	1 000	HV	External	E40	Elliptical - diffuse coating	

J.2 Lamp data sheets

The following pages contain lamp data sheets.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: SE-50-H/I-E27-72/165 (with internal starter)
ILCOS: SE-50-H/E-E27-72/165 (with external starter)

Nominal wattage W	Circuit	Cap	Bulb
50	With internal or external ignitor	E27	Elliptical - clear or with diffuse coating

Dimensions (see Annex B)						
A mm		C mm		D mm	L mm	Deviation [1] °
Min.	Max.	Min.	Max.	Max.	Max.	Max.
23	37	95	115	72	165	3

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for internal ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	60*
*From switch on, value under consideration.			
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	1 800
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		2 per full cycle	
Position (phase angle) of the open circuit voltage	°	one at 90 and one at 270	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7**

** After starting

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference), applicable to clear lamps

[2] Additionally, fixed settings and requirements are given in Annex F.

NOTE There are two designs of lamp presently in use which are compatible in operation, but which require different starting conditions.

Some lamp designs require a minimum pulse height of 1 600 V whereas other designs require a minimum of 1 800 V. Information shall be provided by the lamp manufacturer as to which ignitor pulse height and width are appropriate. For future starting compatibility of both lamp types, it is recommended that ignitors are designed with a minimum pulse height of 1 800 V.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-50-H/I-E27-72/165 (with internal starter)
ILCOS: SE-50-H/E-E27-72/165 (with external starter)

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	50	-	-
Voltage (r.m.s.) at lamp terminals	V	85	70	100
Current (r.m.s.)	A	0,76	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	105	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	50	220	0,76	246	0,075 ± 0,005
60	50	220	0,76	246	0,075 ± 0,005

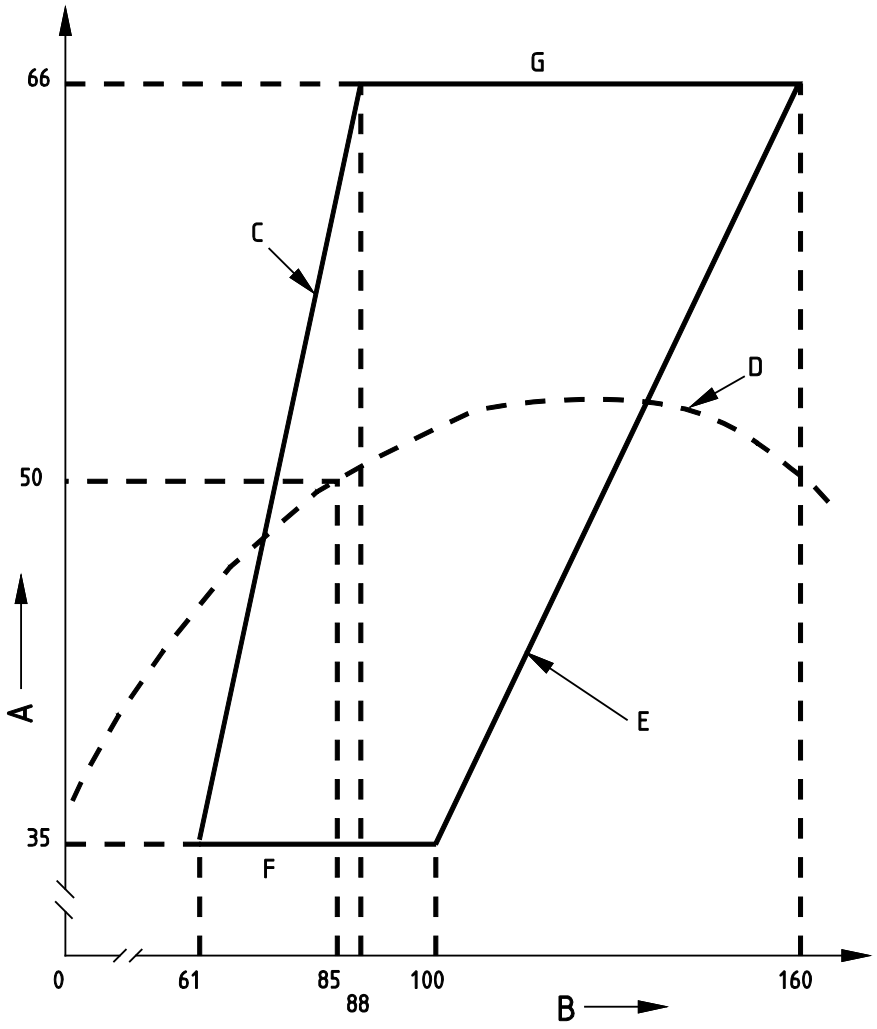
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	0,76	1,52
Pulse height (peak), luminaire requirement	V	-	2 500

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	5
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-50-H/I-E27-72/165 (with internal starter)
ILCOS: SE-50-H/E-E27-72/165 (with external starter)



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key
A Lamp wattage (W)
B Lamp voltage (V)
C Minimum lamp voltage (V)
D Ballast characteristic curve
E Maximum lamp voltage (V)
F Minimum lamp wattage (W)
G Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: ST-50-H/E-E27-39/156

Nominal wattage W	Circuit	Cap	Bulb
50	With external ignitor	E27	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
30	97	107	39	156	3

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	1 800
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		2 per full cycle	
Position (phase angle) of the open circuit voltage	°	one at 90 and one at 270	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

[2] Additionally, fixed settings and requirements are given in Annex F. Current reversals shall be avoided.

NOTE There are two designs of lamp presently in use which are compatible in operation, but which require different starting conditions.

Some lamp designs require a minimum pulse height of 1 600 V whereas other designs require a minimum of 1 800 V.

Information shall be provided by the lamp manufacturer as to which ignitor pulse height and width are appropriate.

For future starting compatibility of both lamp types, it is recommended that ignitors are designed with a minimum pulse height of 1 800 V.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-50-H/E-E27-39/156

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	50	-	-
Voltage (r.m.s.) at lamp terminals	V	85	70	100
Current (r.m.s.)	A	0,76	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	105	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	50	220	0,76	246	0,075 ± 0,005
60	50	220	0,76	246	0,075 ± 0,005

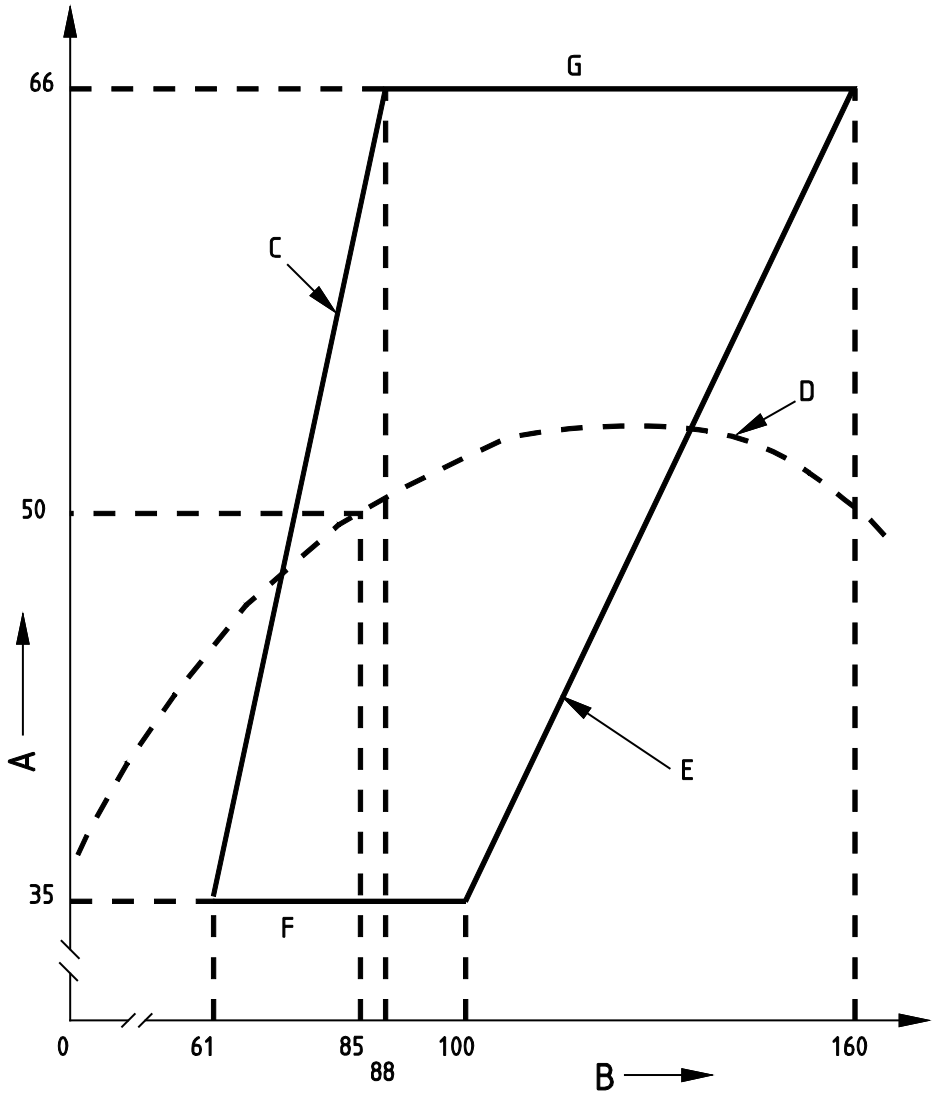
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	0,76	1,52
Pulse height (peak), luminaire requirement	V	-	2 500

Lamp operating limits are shown graphically on page 3.
For ignition, see also clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	5
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-50-H/E-E27-39/156



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: SE-70-H/I-E27-72/165 (with internal starter)
ILCOS: SE-70-H/E-E27-72/165 (with external starter)

Nominal wattage W	Circuit	Cap	Bulb
70	With internal or external ignitor	E27	Elliptical - clear or with diffuse coating

Dimensions (see Annex B)						
A mm		C* mm		D mm	L mm	Deviation [1] °
Min.	Max.	Min.	Max.	Max.	Max.	Max.
28	45	95	115	72	165	3

*Clear finish only

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for internal ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	60*
*From switch on, value under consideration.			
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	1 800
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		2 per full cycle	
Position (phase angle) of the open circuit voltage	°	one at 90 and one at 270	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference), applicable to clear lamps

[2] Additionally, fixed settings and requirements are given in Annex F.

NOTE There are two designs of lamp presently in use which are compatible in operation, but which require different starting conditions.

Some lamp designs require a minimum pulse height of 1 600 V whereas other designs require a minimum of 1 800 V. Information shall be provided by the lamp manufacturer as to which ignitor pulse height and width are appropriate. For future starting compatibility of both lamp types, it is recommended that ignitors are designed with a minimum pulse height of 1 800 V.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-70-H/I-E27-72/165 (with internal starter)
ILCOS: SE-70-H/E-E27-72/165 (with external starter)

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	70	-	-
Voltage (r.m.s.) at lamp terminals	V	90	75	105
Current (r.m.s.)	A	0,98	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	105	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	70	220	0,98	188	0,075 ± 0,005

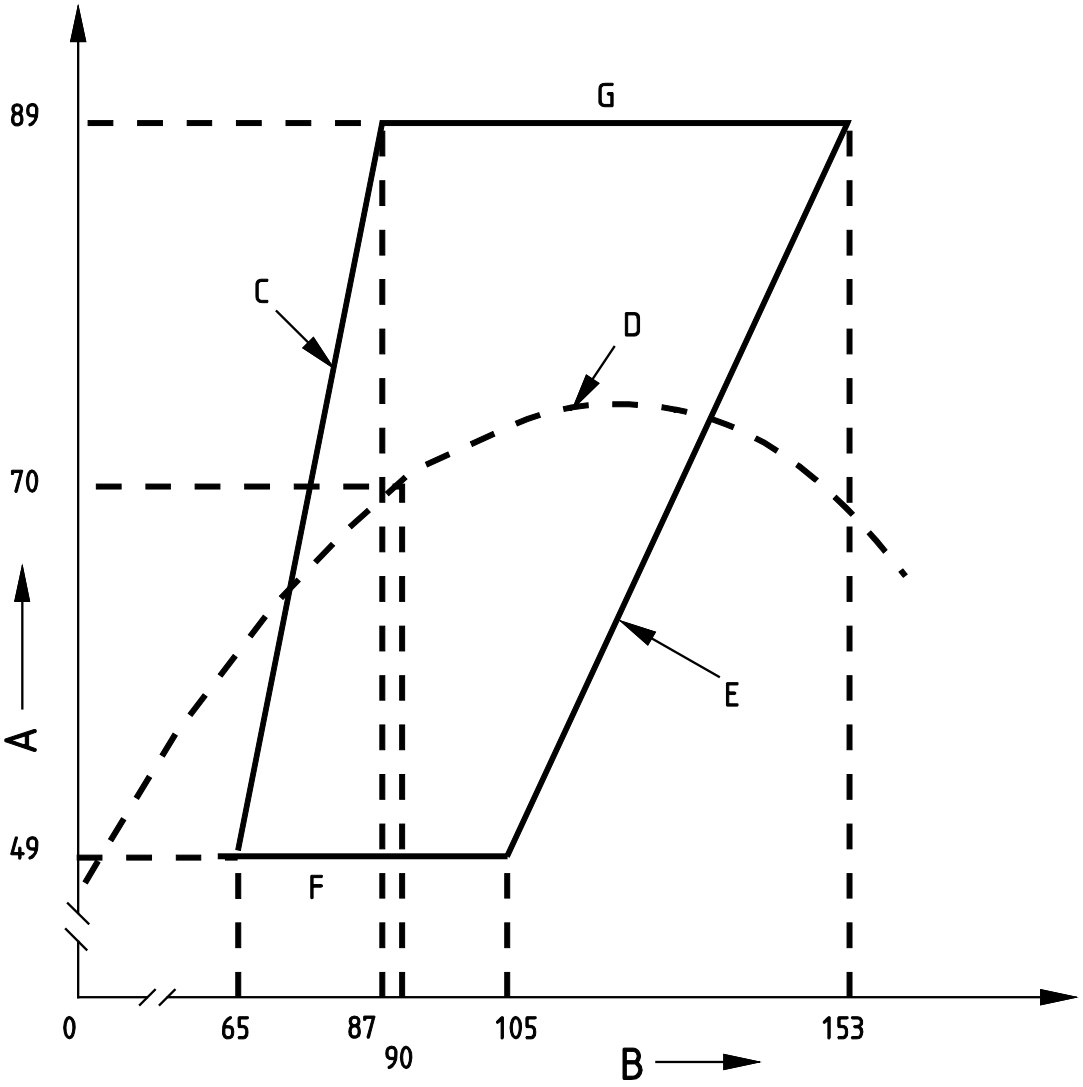
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	0,98	1,96
Pulse height (peak), luminaire requirement	V	-	2 500

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	5
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-70-H/I-E27-72/165 (with internal starter)
ILCOS: SE-70-H/E-E27-72/165 (with external starter)



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key
A Lamp wattage (W)
B Lamp voltage (V)
C Minimum lamp voltage (V)
D Ballast characteristic curve
E Maximum lamp voltage (V)
F Minimum lamp wattage (W)
G Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: ST-70-H/E-E27-39/156

Nominal wattage W	Circuit	Cap	Bulb
70	With external ignitor	E27	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
35	97	107	39	156	3

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	1 800
Duration time T_2 at 90 % of A	μs	-	2
Repetition rate		2 per full cycle	
Position (phase angle) of the open circuit voltage	°	one at 90 and one at 270	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

[2] Additionally, fixed settings and requirements are given in Annex F.

NOTE There are two designs of lamp presently in use which are compatible in operation, but which require different starting conditions.

Some lamp designs require a minimum pulse height of 1 600 V whereas other designs require a minimum of 1 800 V.

Information shall be provided by the lamp manufacturer as to which ignitor pulse height and width are appropriate.

For future starting compatibility of both lamp types, it is recommended that ignitors are designed with a minimum pulse height of 1 800 V.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-70-H/E-E27-39/156

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	70	-	-
Voltage (r.m.s.) at lamp terminals	V	90	75	105
Current (r.m.s.)	A	0,98	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	105	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	70	220	0,98	188	0,075 ± 0,005

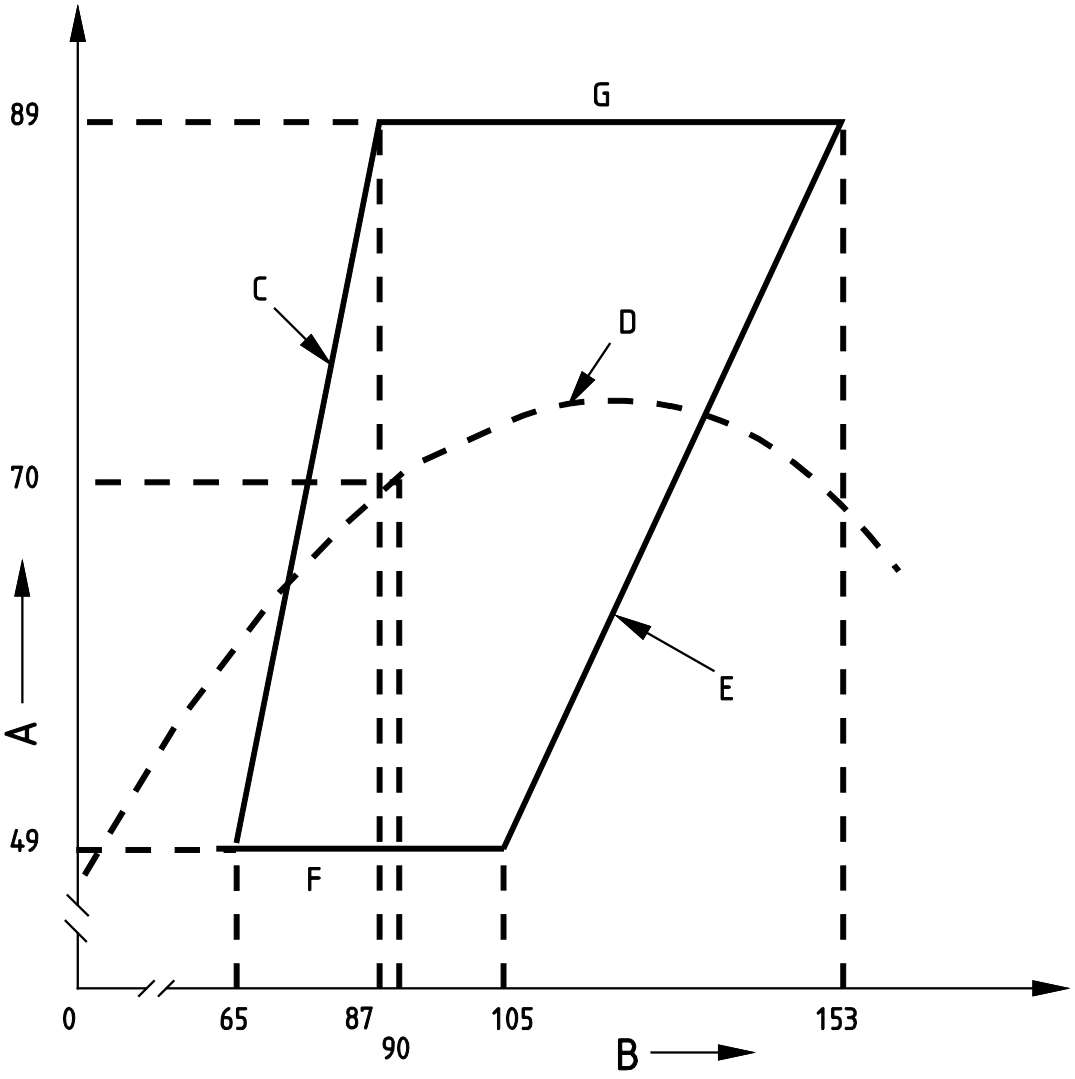
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	0,98	1,96
Pulse height (peak), luminaire requirement	V	-	2 500

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	5
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-70-H/E-E27-39/156



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: SE-70-H/E-E26/24-56/138

Nominal wattage W	Circuit	Cap	Bulb
70	With external ignitor	E26/24	Elliptical - clear or with diffuse coating

Dimensions (see Annex B)						
A mm		C mm		D mm	L mm	Deviation [1] °
Min.	Max.	Min.	Max.	Max.	Max.	Max.
19	35	84	95	56	138	3

Starting and warm-up characteristics				
		Rated	Minimum	Maximum
Starting for external ignitors				
Test voltage (r.m.s.)	V	-	-	110
Starting time	s	-	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)				
Height (peak) A	V	-	-2 200	-2 250
Rise time T_1	μs	-	-	0,100
Width T_2 at 50 % of A	μs	-	0,90	1,00
Warm-up				
Test voltage	V	-	-	110
Time required to reach 26 V minimum at lamp terminals	min	-	-	7

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference), applicable to clear lamps

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-70-H/E-E26/24-56/138

Electrical characteristics						
		Rated	Minimum		Maximum	
Wattage	W	70	-		-	
Voltage (r.m.s.) at lamp terminals	V	52	41 [1)]	44 [2)]	62 [1)]	60 [2)]
Current (r.m.s.)	A	1,6	-		-	
Extinguishing voltage r.m.s. (see 8.6)	V	62	-		-	

[1)] at input voltage; [2)] at set input wattage
Only one method of how to obtain the lamp voltage shall be used and stated as such.

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	70	120	1,6	61	0,075 ± 0,005

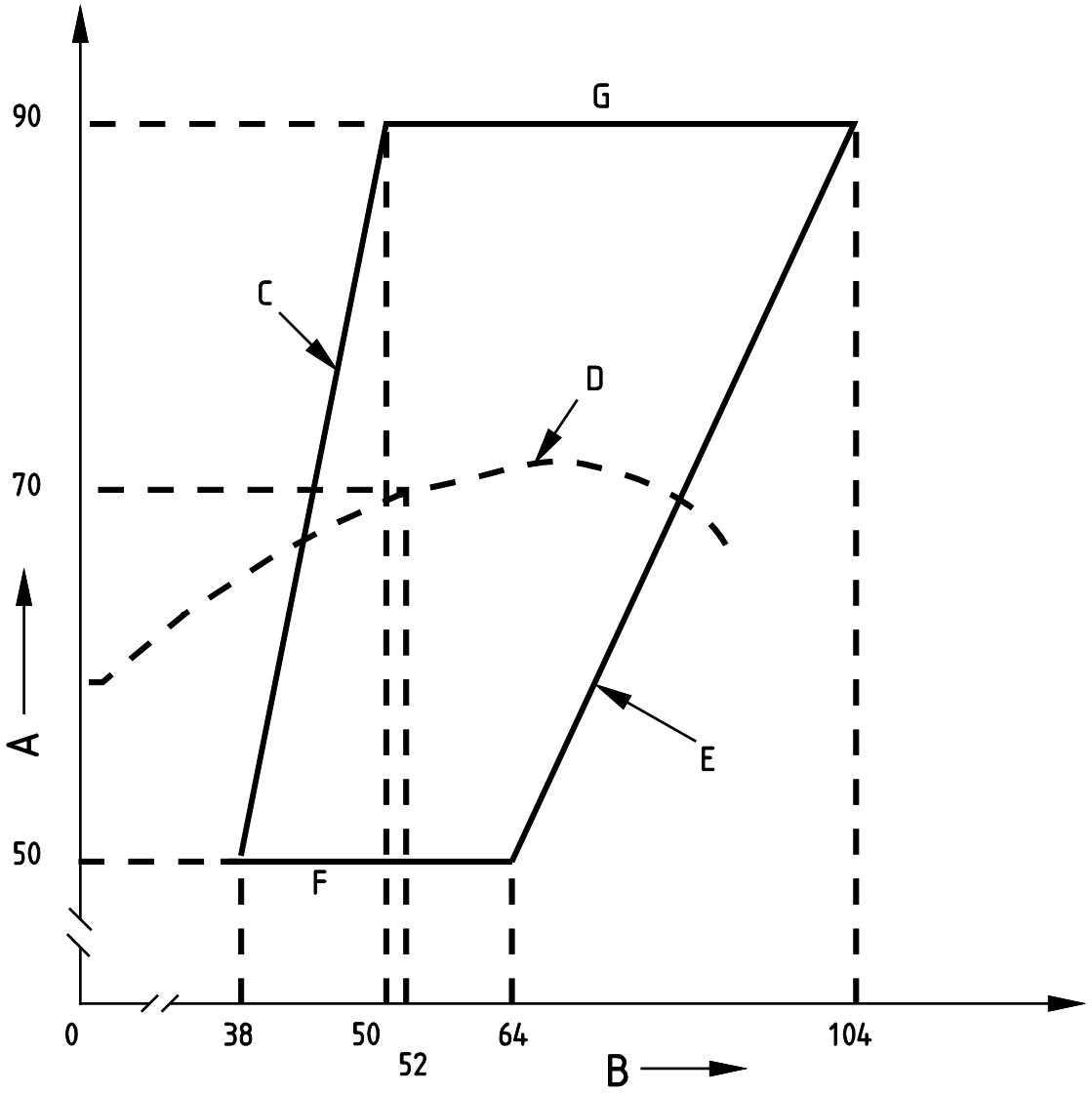
Information for ballast and ignitor design			
		Minimum	Maximum
Open circuit voltage (r.m.s.), lag circuit	V	110	-
Open circuit voltage (r.m.s.), lead circuit	V	110	
Pulse height (peak)	V	-2 500	-
Pulse width	μs	1 at 2 250 V	
Lamp warm-up current (r.m.s.)	A	1,6	2,4
Pulse height (peak), luminaire requirement	V	-	-4 000
Current off time at maximum short-circuit current	ms		not applicable
Current off time at nominal lamp operating current	ms		not applicable

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	4
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-70-H/E-E26/24-56/138



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: SE-100-H/E-E40-78/186

Nominal wattage W	Circuit	Cap	Bulb
100	With external ignitor	E40	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	78	186	-

Starting and warm-up characteristics [1]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	5

[1] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 2

ILCOS: SE-100-H/E-E40-78/186

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	100	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	1,2	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	120	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	100	220	1,2	148	0,06 ± 0,005

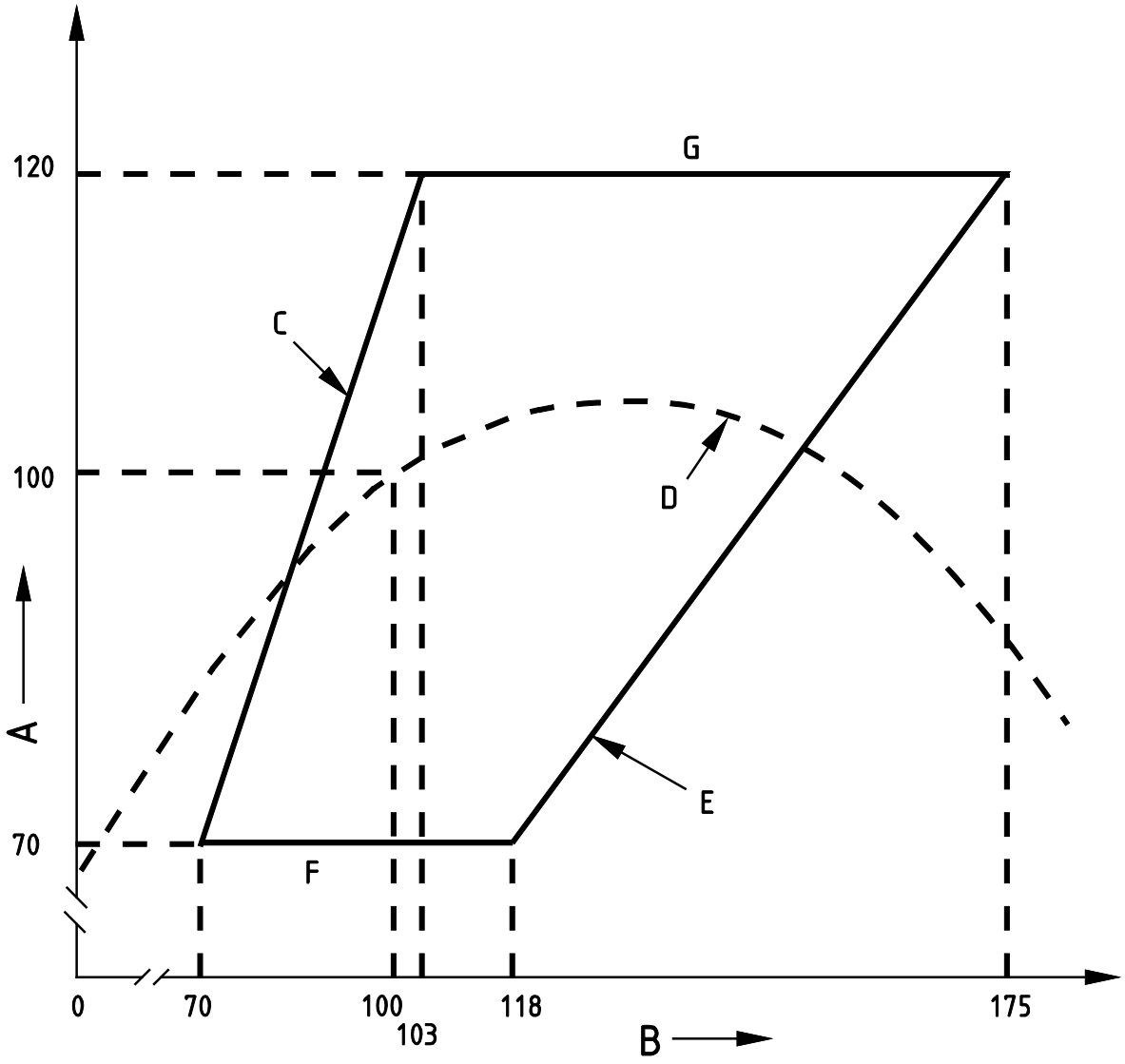
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	1,2	2,4
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	5
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-100-H/E-E40-78/186



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: SE-100-H/E-E39-80/197

Nominal wattage W	Circuit	Cap	Bulb
100	With external ignitor	E39	Elliptical - clear or diffuse coating

Dimensions (see Annex B)				
A mm	C mm	D mm	L mm	Deviation[1)] °
Nominal	Nominal	Max.	Max.	Max.
36	127	80	197	3

Starting and warm-up characteristics				
		Rated	Minimum	Maximum
Starting for external ignitors				
Test voltage (r.m.s.)	V	-	-	110
Starting time	s	-	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)				
Height (peak) A	V	-	-2 200	-2 250
Rise time T_1	µs	-	-	0,100
Width T_2 at 50 % of A	µs	-	0,90	1,00
Warm-up				
Test voltage	V	-	-	110
Time after starting required to reach 28 V minimum at lamp terminals	min	-	-	5

[1)] Deviation of any point along the centre line of the arc tube from the axis of the cap (apex of the cap eyelet used as the point of reference), applicable to clear lamps.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-100-H/E-E39-80/197

Electrical characteristics						
		Rated	Minimum		Maximum	
Wattage	W	100	-		-	
Voltage (r.m.s.) at lamp terminals	V	55	42 [1)]	45 [2)]	63 [1)]	62 [2)]
Current (r.m.s.)	A	2,1	-		-	
Extinguishing voltage r.m.s. (see 8.6)	V	63	-		-	

[1)] at input voltage; [2)] at set input wattage
Only one method of how to obtain the lamp voltage shall be used and stated as such.

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	100	120	2,1	44	0,075 ± 0,005

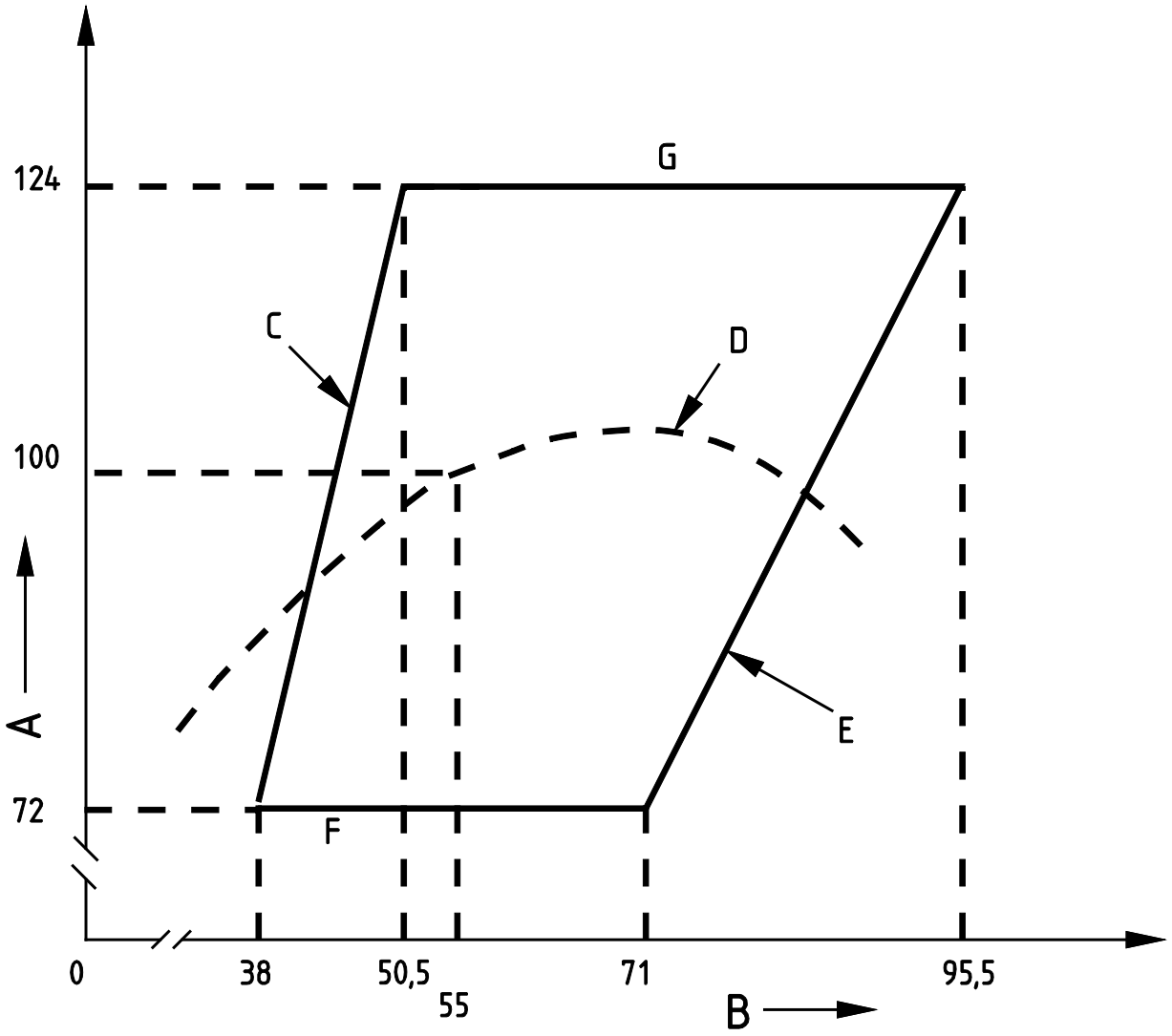
Information for ballast and ignitor design			
		Minimum	Maximum
Open circuit voltage (r.m.s.), lag circuit	V	110	-
Open circuit voltage (r.m.s.), lead circuit	V	110	-
Pulse height (peak)	V	-2 500	-
Pulse width	μs	1 at 2 250 V	
Lamp warm-up current (r.m.s.)	A	2,1	3,2
Pulse height (peak), luminaire requirement	V	-	-4 000
Current off time at maximum short-circuit current	ms		not applicable
Current off time at nominal lamp operating current	ms		not applicable

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	4
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-100-H/E-E39-80/197



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: ST-100-H/E-E40-48/211

Nominal wattage W	Circuit	Cap	Bulb
100	With external ignitor	E40	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
40	127	137	48	211	3

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	5

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

[2] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-100-H/E-E40-48/211

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	100	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	1,2	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	120	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	100	220	1,2	148	0,06 ± 0,005

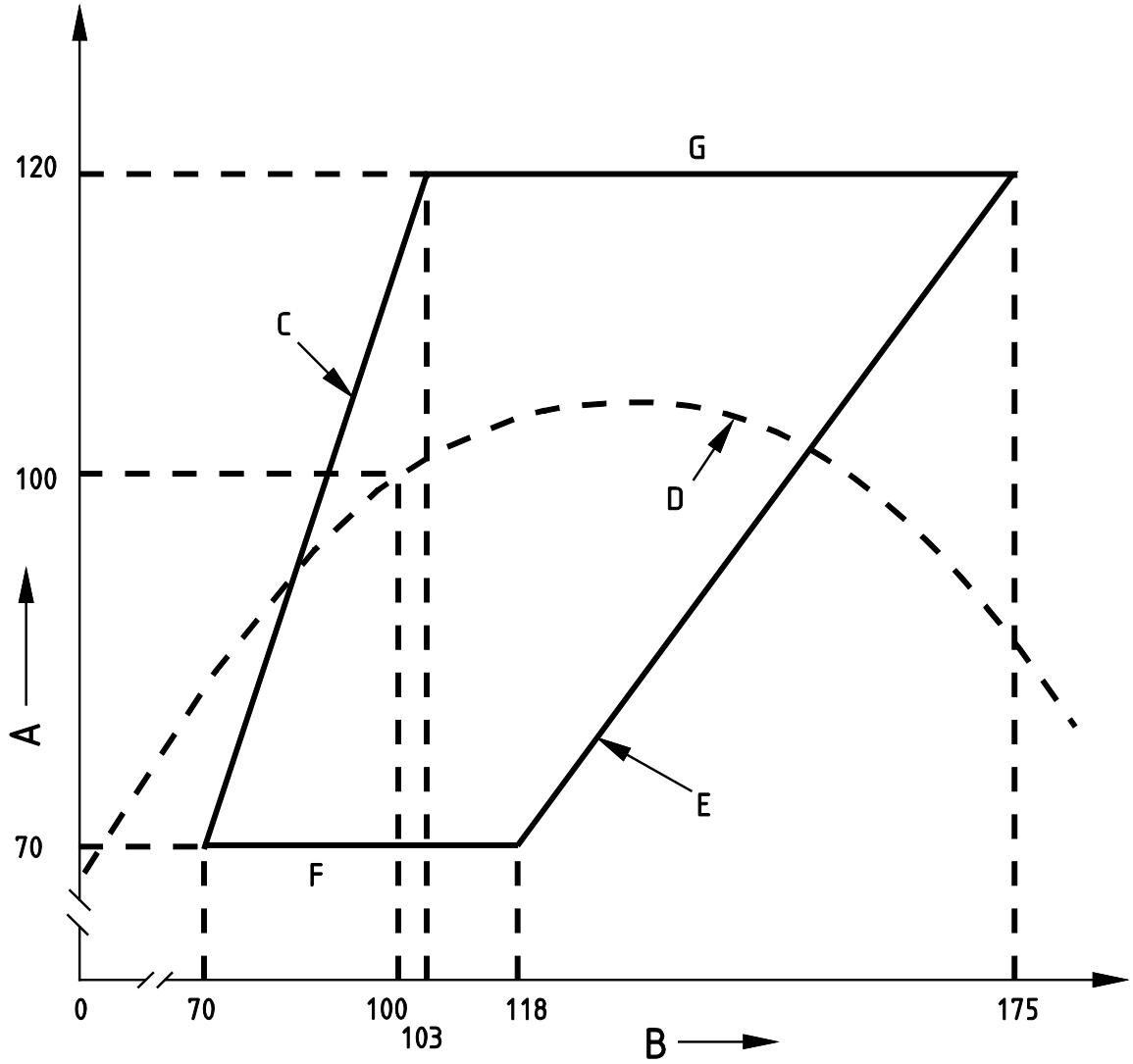
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	1,2	2,4
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	7
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-100-H/E-E40-48/211



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: ST-150-H/E-E40-48/211 (with external starter)
ILCOS: ST-150-H/i-E40-48/211 (with internal starter)

Nominal wattage W	Circuit	Cap	Bulb
150	With internal or external ignitor	E40	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
55	127	137	48	211	3

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for internal ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	120*
*From switch on, value under consideration.			
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	5

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

[2] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-150-H/E-E40-48/211 (with external starter)
ILCOS: ST-150-H/i-E40-48/211 (with internal starter)

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	150	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	1,8	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	116	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	150	220	1,8	99,0	0,06 ± 0,005

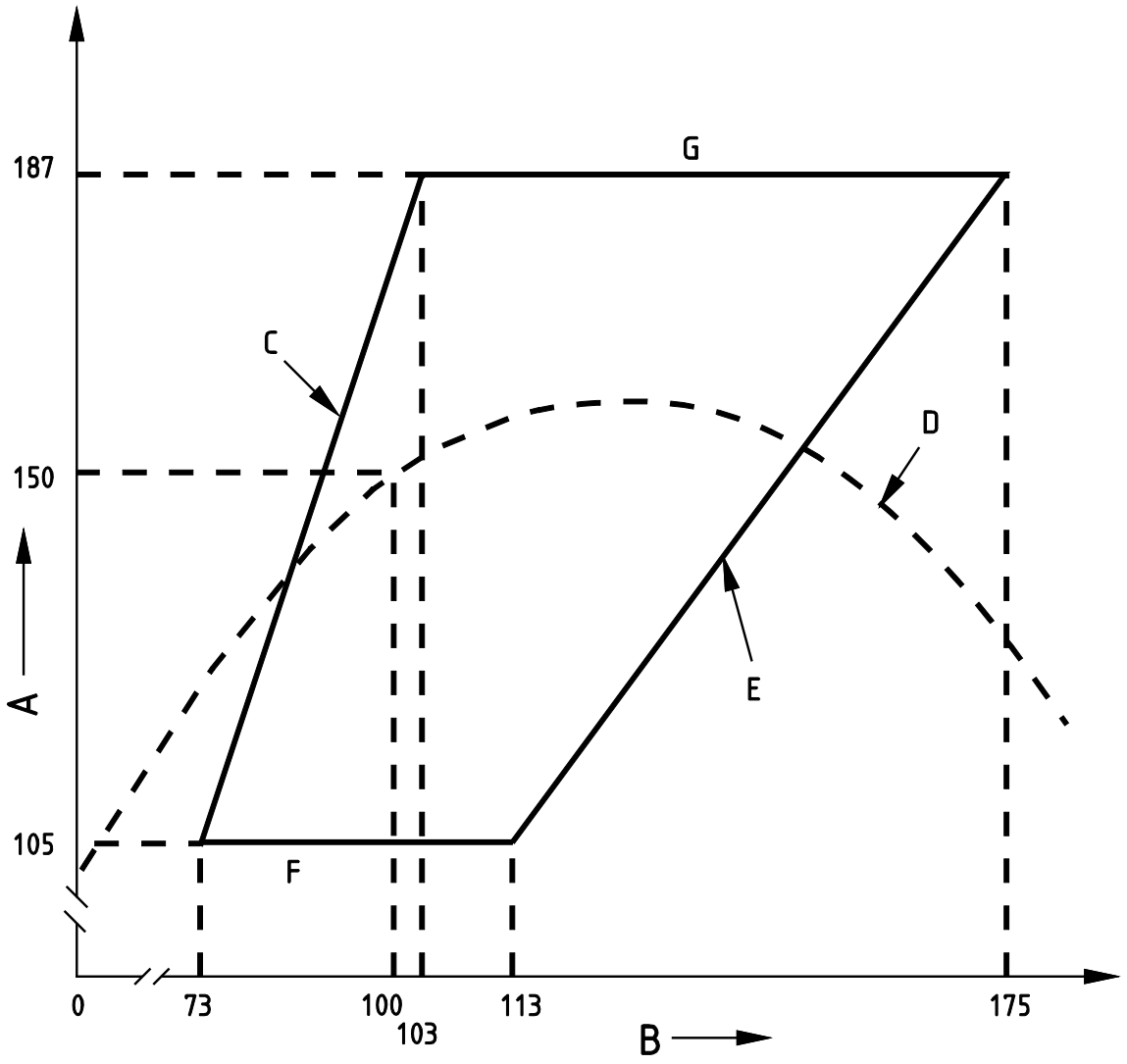
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	1,8	3,0
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	7
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-150-H/E-E40-48/211 (with external starter)
ILCOS: ST-150-H/i-E40-48/211 (with internal starter)



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: ST-150-H/E-E39-52/250

Nominal wattage W	Circuit	Cap	Bulb
150	With external ignitor	E39	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
55	155	165	52	250	3

Starting and warm-up characteristics [2]			
	Rated	Minimum	Maximum
Starting for external ignitors			
Test voltage (r.m.s.) V	-	-	180
Starting time s	-	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.1)			
Height (peak) A V	2 475	-	2 500
Width T_2 at 50 % of A µs	-	-	1,00
Repetition rate	1/half cycle		
Phase angle °	60~90, 240~270		
Warm-up			
Test voltage V	-	-	180
Time required to reach 45 V minimum at lamp terminals min	-	-	5

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

[2] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-150-H/E-E39-52/250

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	148	-	-
Voltage (r.m.s.) at lamp terminals	V	90	65	110
Current (r.m.s.)	A	2,0	1,7	2,3
Extinguishing voltage r.m.s. (see 8.6)	V	111	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	150	200	2,0	81,0 ± 0,5%	0,060 ± 0,010
60	150	200	2,0	81,0 ± 0,5%	0,060 ± 0,010

Information for ballast and ignitor design			
		Minimum	Maximum
Pulse width	µs	*	
Lamp warm-up current (r.m.s.)	A	2,00	3,60
Pulse height (peak), luminaire requirement	V	2 700	4 500

Lamp operating limits are shown graphically on page 3.

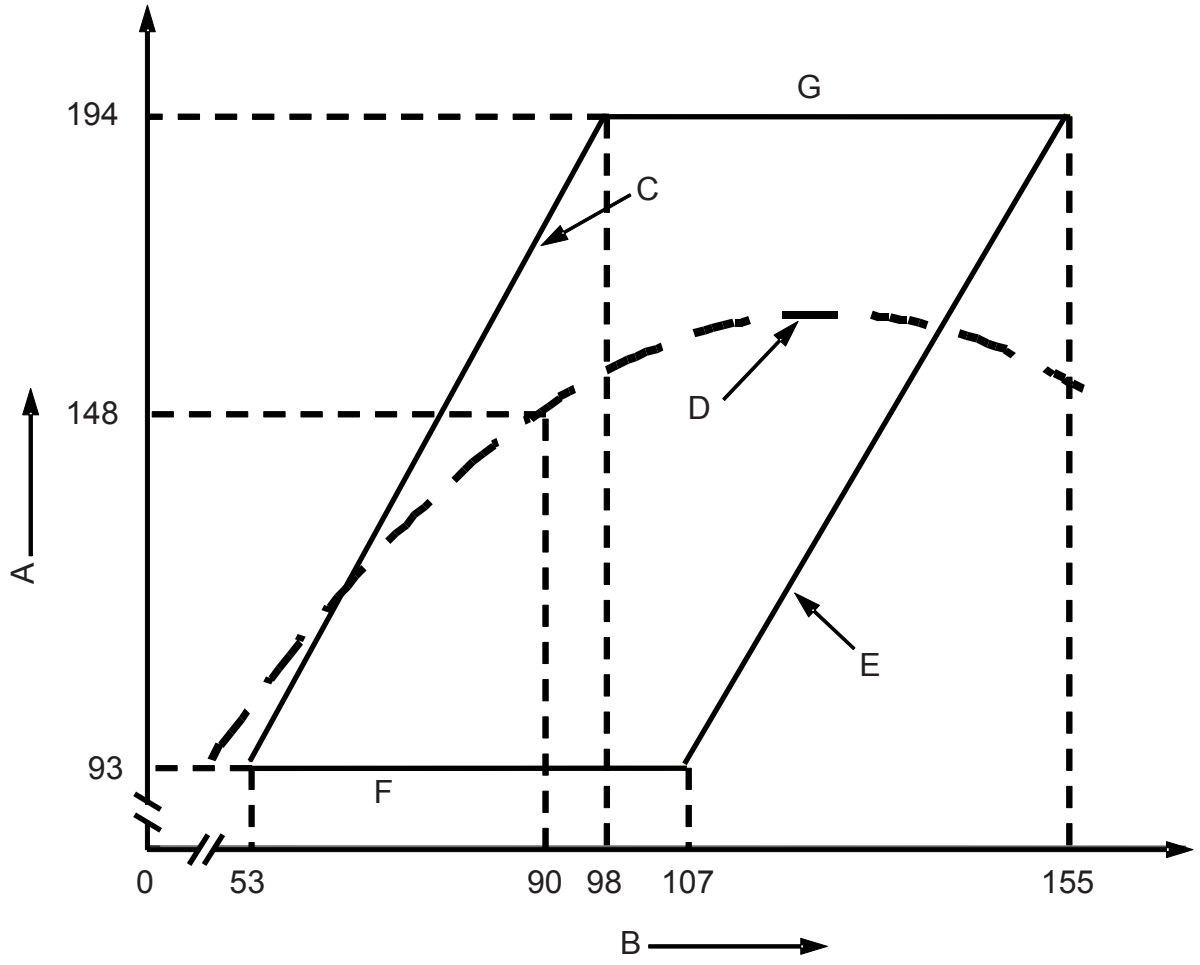
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

* under consideration

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-150-H/E-E39-52/250



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: SE-150-H/E-E40-91/227 (with external starter)
ILCOS: SE-150-H/I-E40-91/227 (with internal starter)

Nominal wattage W	Circuit	Cap	Bulb
150	With internal or external ignitor	E40	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	91	227	-

Starting and warm-up characteristics [1)]			
		Rated	Maximum
Starting for internal ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	120*
*From switch on, value under consideration.			
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	5

[1)] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-150-H/E-E40-91/227 (with external starter)
ILCOS: SE-150-H/I-E40-91/227 (with internal starter)

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	150	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	1,8	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	116	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	150	220	1,8	99,0	0,06 ± 0,005

Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	1,8	3,0
Pulse height (peak), luminaire requirement	V	-	5 000

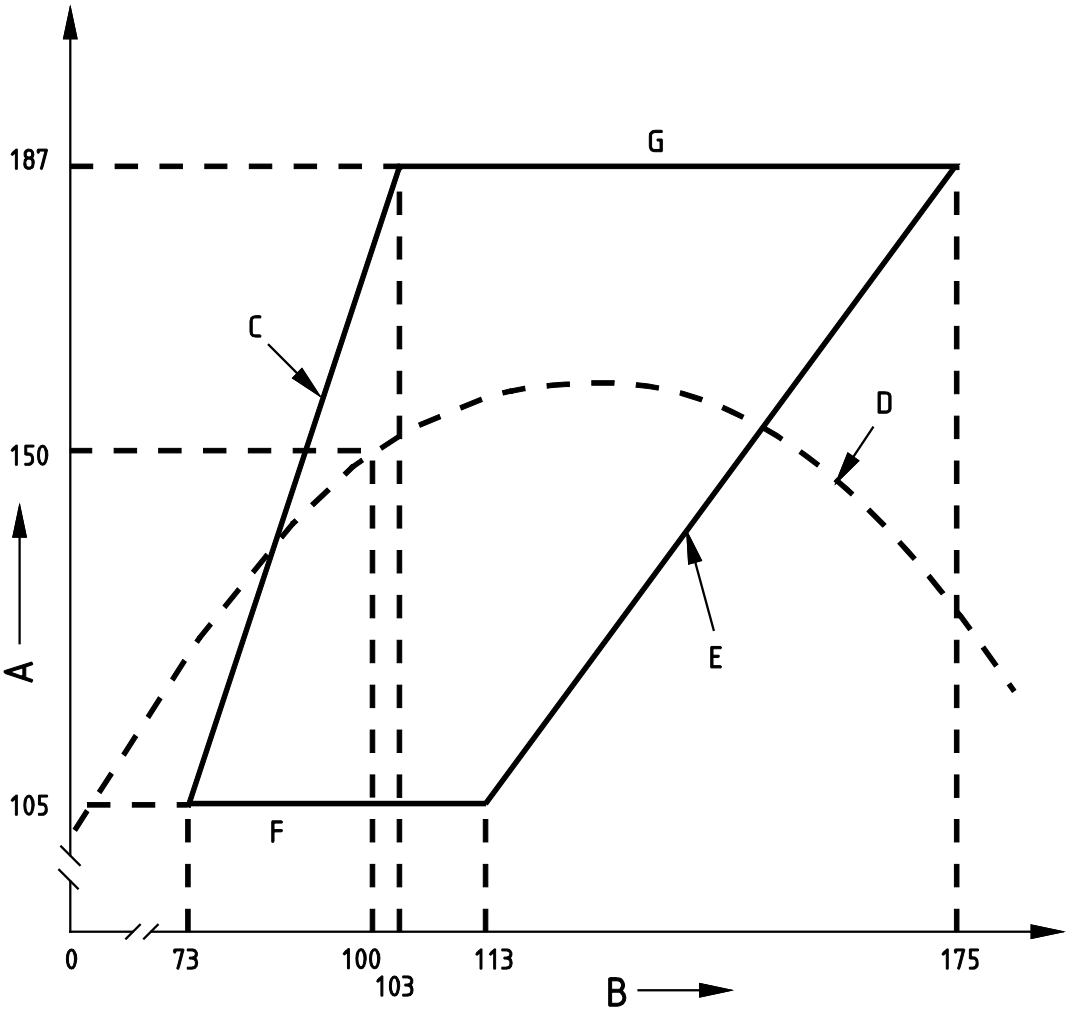
Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	5
Operating position limitation		As indicated by the lamp manufacturer

* Under consideration.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-150-H/E-E40-91/227 (with external starter)
ILCOS: SE-150-H/I-E40-91/227 (with internal starter)



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: SE-150-H/E-E39-91/227 (with external starter)
ILCOS: SE-150-H/I-E39-91/227 (with internal starter)

Nominal wattage W	Circuit	Cap	Bulb
150	With internal or external ignitor	E39	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	91	227	-

Starting and warm-up characteristics				
		Rated	Minimum	Maximum
Starting for internal ignitors				
Test voltage (r.m.s.)	V	-	-	198
Starting time	s	-	-	5
Starting for external ignitors				
Test voltage (r.m.s.)	V	-	-	198
Starting time	s	-	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)				
Height (peak) A	V	-	-2 200	-2 250
Rise time T_1	µs	-	-	0,100
Width T_2 at 50 % of A	µs	-	0,90	1,00
Warm-up				
Test voltage	V	-	-	198
Time required to reach 50 V minimum at lamp terminals	min	-	-	5

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-150-H/E-E39-91/227 (with external starter)
ILCOS: SE-150-H/I-E39-91/227 (with internal starter)

Electrical characteristics						
		Rated	Minimum		Maximum	
Wattage	W	150	-		-	
Voltage (r.m.s.) at lamp terminals	V	100	75 [1)]	85 [2)]	117 [1)]	115 [2)]
Current (r.m.s.)	A	1,8	-		-	
Extinguishing voltage r.m.s. (see 8.6)	V	116	-		-	

[1)] at input voltage; [2)] at set input wattage
Only one method of how to obtain the lamp voltage shall be used and stated as such.

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	150	220	1,8	97,0	0,075 ± 0,005

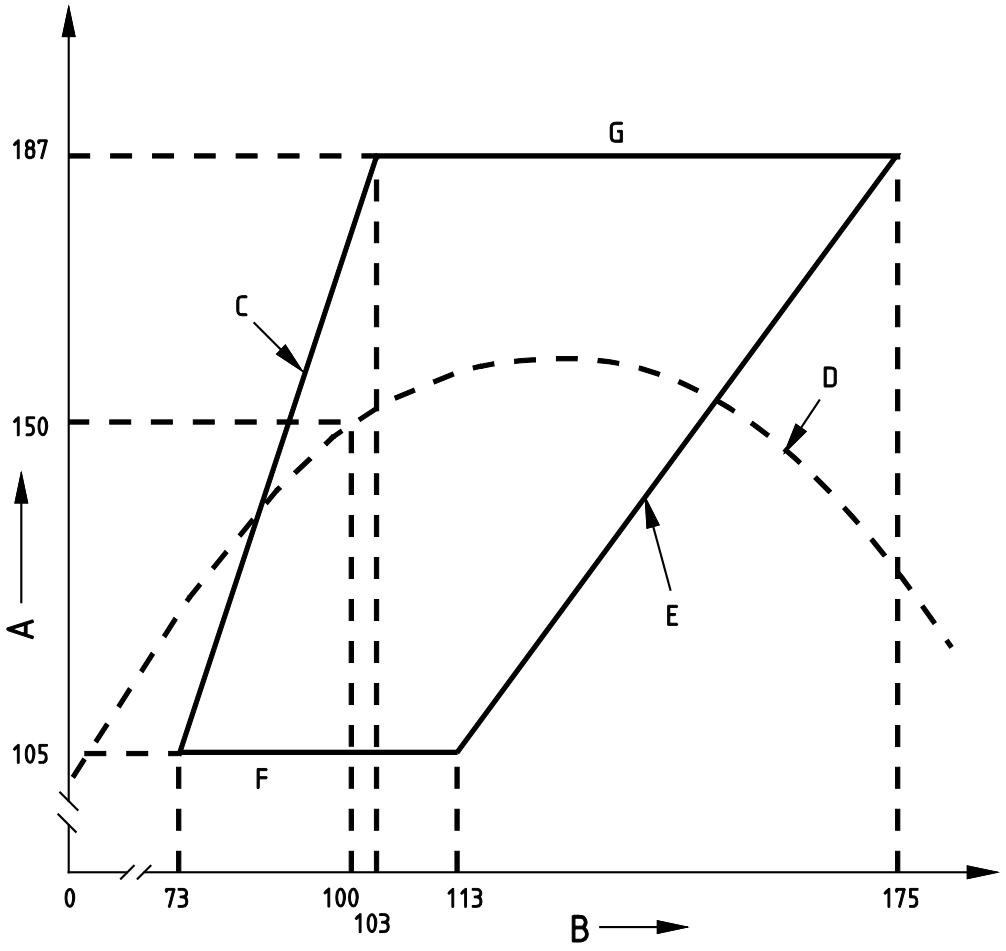
Information for ballast and ignitor design			
		Minimum	Maximum
Open circuit voltage (r.m.s.), lag circuit	V	198	-
Open circuit voltage (r.m.s.), lead circuit	V	198	-
Pulse height (peak)	V	-2 800	-
Pulse width	μs	1 at 2 250 V	
Lamp warm-up current (r.m.s.)	A	1,8	3,0
Pulse height (peak), luminaire requirement	V	-	-5 000
Current off time at maximum short-circuit current	ms		2,5
Current off time at nominal lamp operating current	ms		2,0

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	7
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-150-H/E-E39-91/227 (with external starter)
ILCOS: SE-150-H/I-E39-91/227 (with internal starter)



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: SE-150-L/E-E39-92/197

Nominal wattage W	Circuit	Cap	Bulb
150	With external ignitor	E39	Elliptical - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
40	122	132	92,2	197	3

Starting and warm-up characteristics				
		Rated	Minimum	Maximum
Starting				
Test voltage (r.m.s.)	V	-	-	110
Starting time	s	-	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)				
Height (peak) A	V	-2 250	-2 225	-2 275
Rise time T_1	μs	-	-	0,100
Width T_2 at 50 % of A	μs	0,95	0,90	1,00
Warm-up				
Test voltage	V	-	-	110
Time required to reach 50 V minimum at lamp terminals	min	-	-	5

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-150-L/E-E39-92/197

Electrical characteristics						
		Rated	Minimum		Maximum	
Wattage	W	150	-		-	
Voltage (r.m.s.) at lamp terminals	V	55	45 [1)]	48 [2)]	64 [1)]	62 [2)]
Current (r.m.s.)	A	3,2	-		-	
Extinguishing voltage r.m.s. (see 8.6)	V	-	-		-	

[1)] at input voltage; [2)] at set input wattage
Only one method of how to obtain the lamp voltage shall be used and stated as such.

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	150	120	3,2	30	0,075 ± 0,005

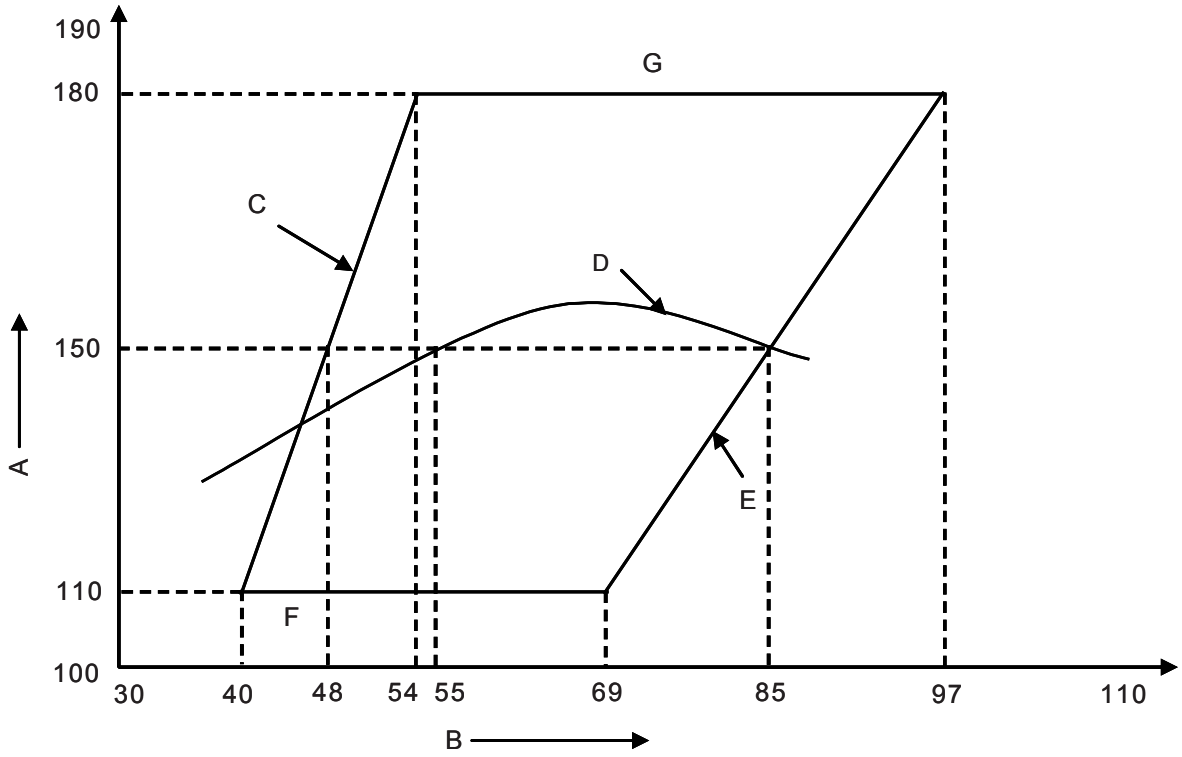
Information for ballast and ignitor design			
		Minimum	Maximum
Open circuit voltage (r.m.s.), lag circuit	V	110	-
Open circuit voltage (r.m.s.), lead circuit	V	110	-
Pulse height (peak)	V	-2 500	-4 000
Pulse width	μs	1 at 2 250 V	
Lamp warm-up current (r.m.s.)	A	3,2	4,8
Pulse height (peak), luminaire requirement	V	-	-4 000
Current off time at maximum short-circuit current	ms		2,5
Current off time at nominal lamp operating current	ms		2,0

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	5
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-150-L/E-E39-92/197



A typical ballast characteristic curve at rated supply voltage is shown in the diagram.

Key
A Lamp wattage (W)
B Lamp voltage (V)
C Minimum lamp voltage (V)
D Ballast characteristic curve
E Maximum lamp voltage (V)
F Minimum lamp wattage (W)
G Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **COLOUR IMPROVED** **DATA SHEET**	Page 1

ILCOS: STM-150-H/E-E40-48/211

Nominal wattage W	Circuit	Cap	Bulb
150	With external ignitor	E40	Tubular - clear

Dimensions (see Annex B)					
A [1] mm	C mm		D mm	L mm	Deviation [2] °
Nominal	Min.	Max.	Max.	Max.	Max.
40	127	137	48	211	3

Starting and warm-up characteristics [3]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

[1] There are presently also lamp designs with a nominal arc length of 70 mm.
[2] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)
[3] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 2

ILCOS: STM-150-H/E-E40-48/211

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	148	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	1,8	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	116	-	-

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 170
Chromaticity co-ordinates x/y (nominal)		0,510/0,420
Colour rendering index R_a (nominal)		≥60

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	150	220	1,8	99,0	0,06 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	1,8	3,0
Pulse height (peak), luminaire requirement	V	-	5 000

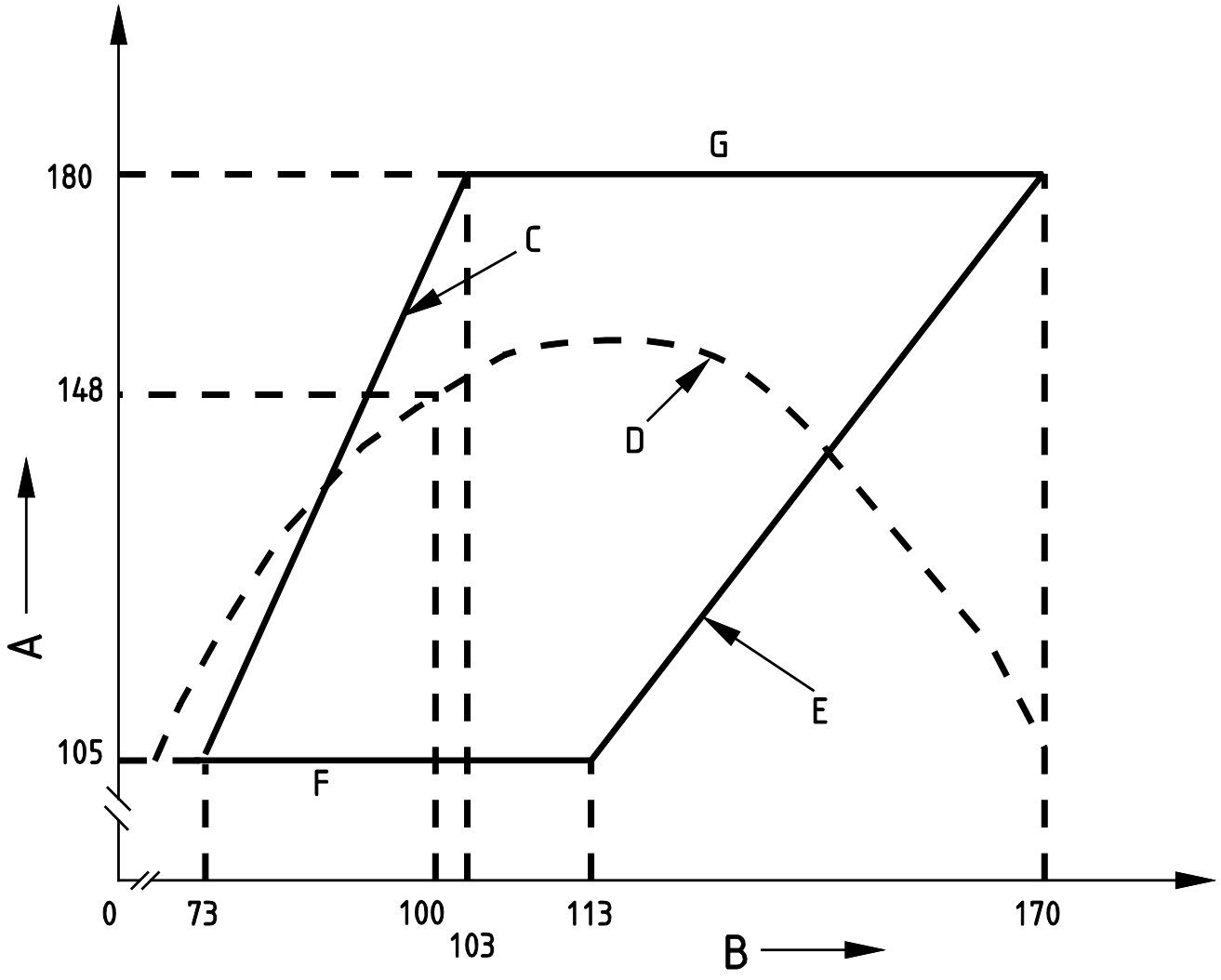
Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	7
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 3

ILCOS: STM-150-H/E-E40-48/211



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 1

ILCOS: SEM-150-H/E-E40-91/227

Nominal wattage W	Circuit	Cap	Bulb
150	With external ignitor	E40	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	91	227	-

Starting and warm-up characteristics [1)]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

[1)] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 2

ILCOS: SEM-150-H/E-E40-91/227

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	148	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	1,8	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	116	-	-

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 170
Chromaticity co-ordinates x/y (nominal)		0,510/0,420
Colour rendering index R_a (nominal)		≥60

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	150	220	1,8	99,0	0,06 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	1,8	3,0
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

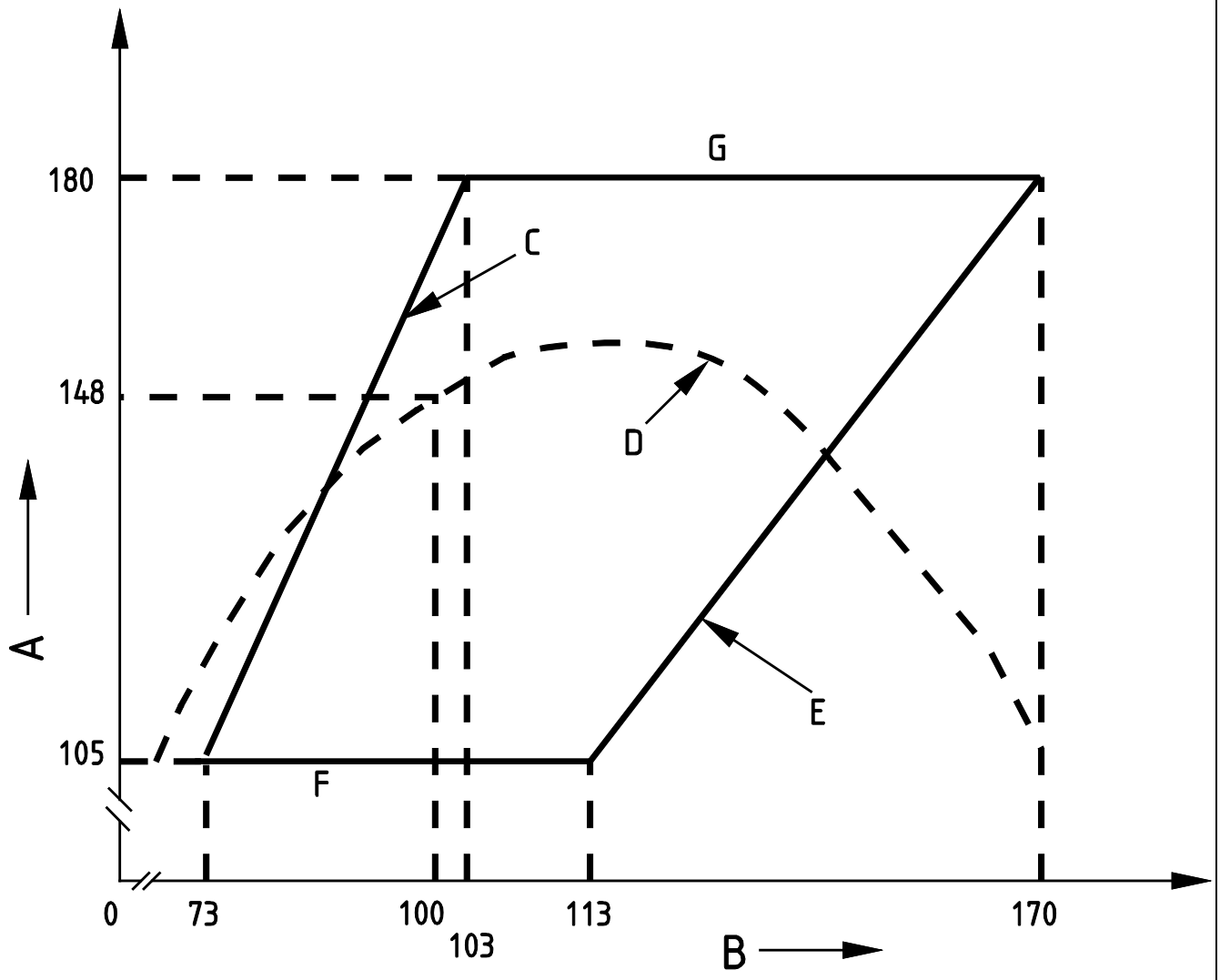
[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	5*
Operating position limitation		As indicated by the lamp manufacturer

* under consideration

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 3

ILCOS: SEM-150-H/E-E40-91/227



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 1

ILCOS: SEM-150-H/E-E39-91/227

Nominal wattage W	Circuit	Cap	Bulb
150	With external ignitor	E39	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	91	227	-

Starting and warm-up characteristics			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (see Subclause 9.3 and Annex A, A.2)			
Height (peak) A	V	-2 200	-2 250
Rise time T_1	µs	0,90	0,100
Duration time T_2 at 50 % of A	µs	-	1,00
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 2

ILCOS: SEM-150-H/E-E39-91/227

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	148	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	1,8	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	116	-	-

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 170
Chromaticity co-ordinates x/y (nominal)		0,510/0,420
Colour rendering index R_a (nominal)		≥60

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	150	220	1,8	97,0	0,075 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	1,8	3,0
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.

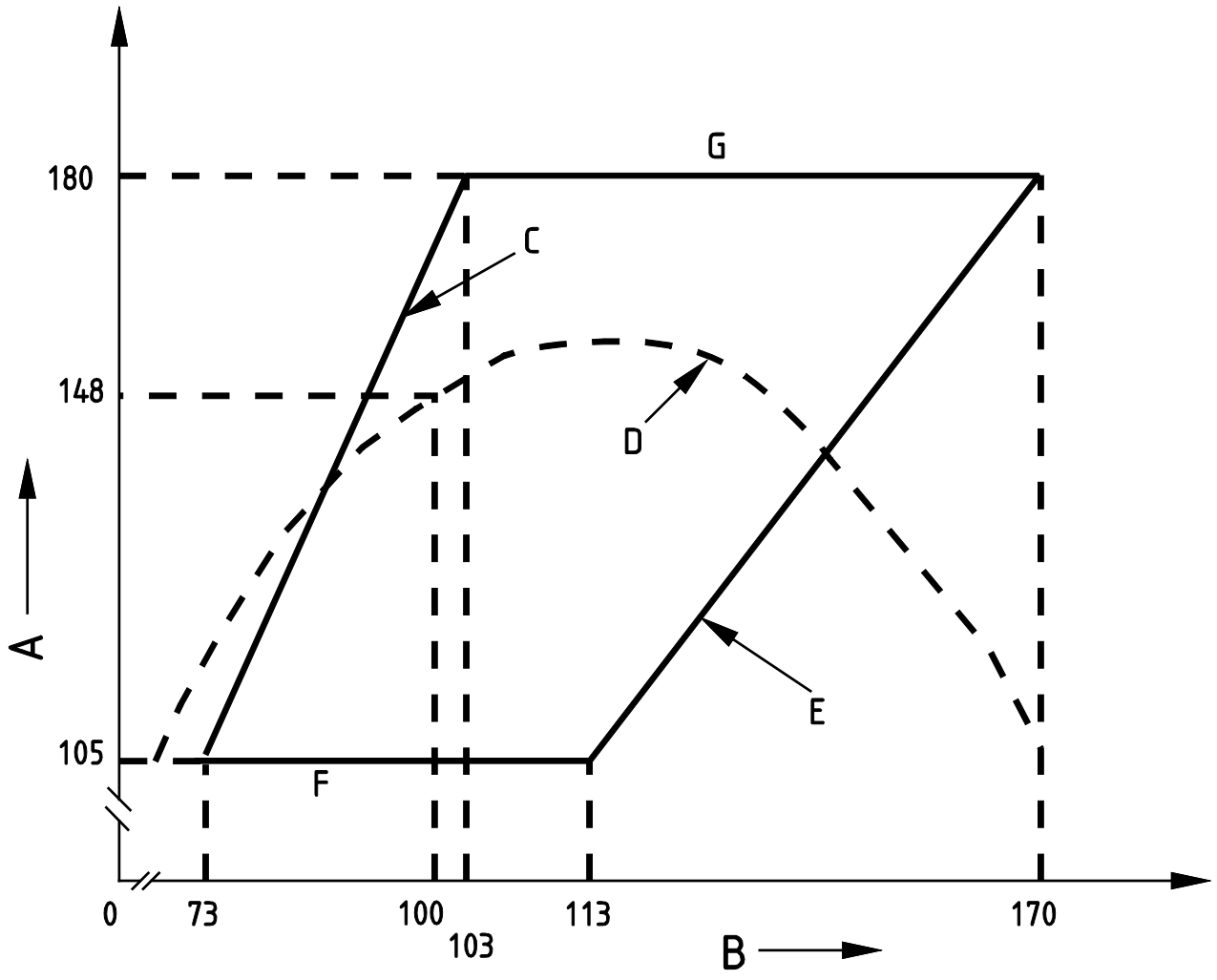
[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	5*
Operating position limitation		As indicated by the lamp manufacturer

* under consideration

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 3

ILCOS: SEM-150-H/E-E39-91/227



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **(with high colour rendering)** **DATA SHEET**	Page 1

ILCOS: SEH-150-H/I-E39-102/250

Nominal wattage W	Circuit	Cap	Bulb
150	With internal ignitor	E39	Elliptical - clear or diffuse coating

Dimensions (see Annex B)					
A* mm	C* mm		D mm	L mm	Deviation [1)] °
Nominal	Min.	Max.	Max.	Max.	Max.
33	155	165	102	250	3

* For clear bulb types

Starting and warm-up characteristics			
		Rated	Maximum
Starting for internal ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	60*

*From switch on

Warm-up			
Test voltage	V		220
Time required to reach 50 V minimum at lamp terminals	min	-	10

[1)] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference), applicable to clear lamps

	HIGH PRESSURE SODIUM VAPOUR LAMPS (with high colour rendering) DATA SHEET	Page 2

ILCOS: SEH-150-H/I-E39-102/250

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	150	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	110
Current (r.m.s.)	A	1,9	1,71	2,14
Extinguishing voltage r.m.s. (see 8.6)	V	130*	-	-

* under consideration

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 500
Chromaticity co-ordinates x/y (nominal)		0,478/0,415
Colour rendering index R_a (nominal)		85

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50 or 60	150	220	1,9	88,6	0,075 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	1,9	3,0
Pulse height (peak), luminaire requirement	V	-	4 500

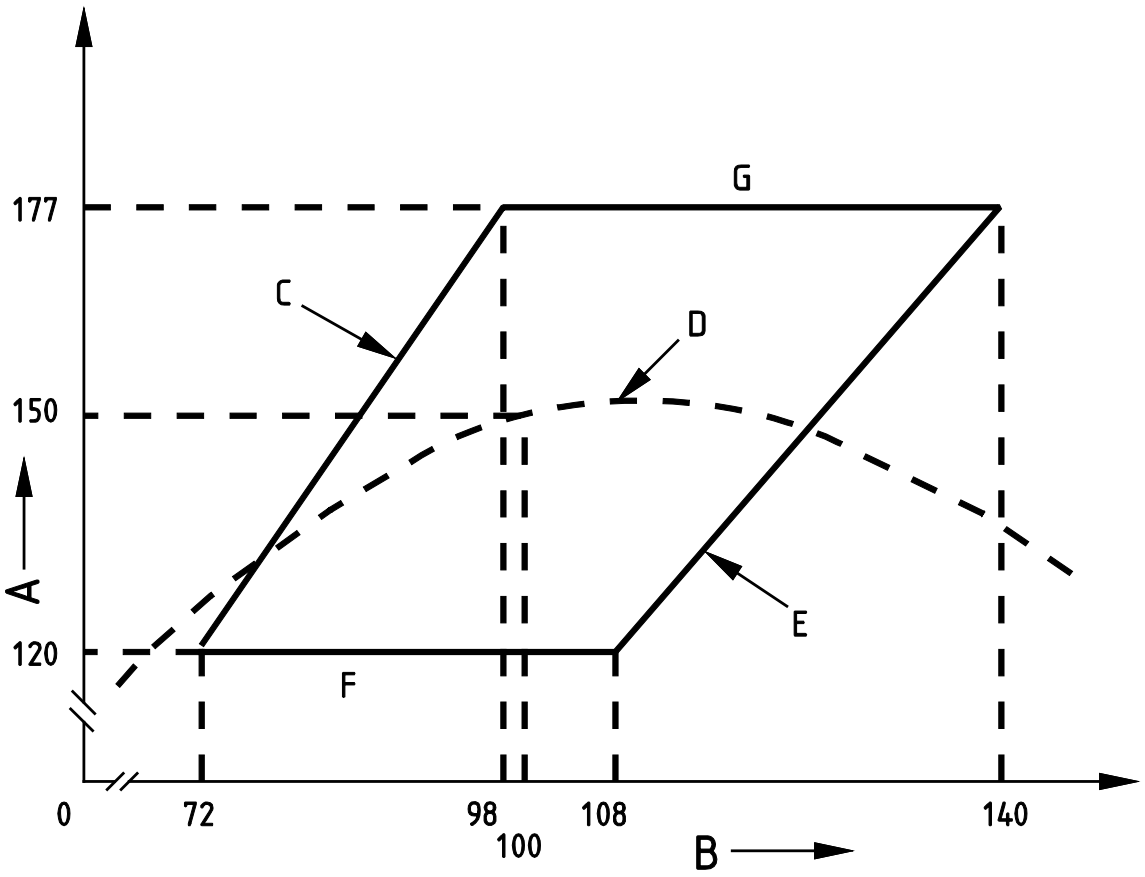
Lamp operating limits are shown graphically on page 3.

[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS (with high colour rendering) DATA SHEET	Page 3

ILCOS: SEH-150-H/I-E39-102/250



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key
A Lamp wattage (W)
B Lamp voltage (V)
C Minimum lamp voltage (V)
D Ballast characteristic curve
E Maximum lamp voltage (V)
F Minimum lamp wattage (W)
G Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: ST-250-H/E-E40-48/260 (with external starting device)
ILCOS: ST-250-H/I-E40-48/260 (with internal starting device)

Nominal wattage W	Circuit	Cap	Bulb
250	With internal or external ignitor	E40	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
65	153	163	48	260	3

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for internal ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	90*
*From switch on, value under consideration.			
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle)	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	5

[1] Deviation of any point along the centre line of the arc tube from the axis of the cap (apex of the cap eyelet used as the point of reference).

[2] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 2

ILCOS: ST-250-H/E-E40-48/260 (with external starting device)
ILCOS: ST-250-H/I-E40-48/260 (with internal starting device)

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	250	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	3,0	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	120	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	250	220	3,0	60,0	0,06 ± 0,005

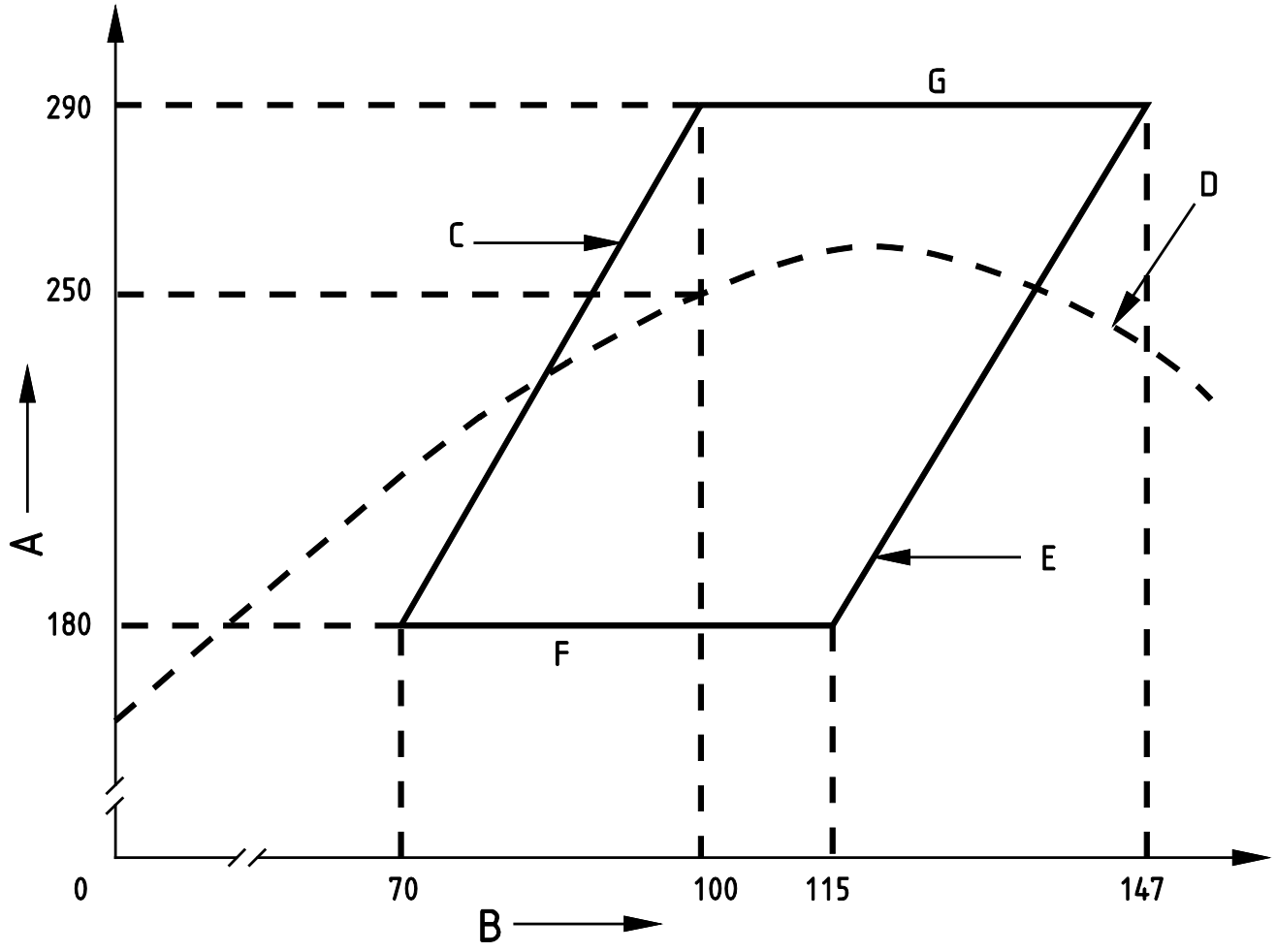
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	3,0	5,2
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-250-H/E-E40-48/260 (with external starting device)
ILCOS: ST-250-H/I-E40-48/260 (with internal starting device)



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: ST-250-H/E-E39-59/248 (with external starting device)
ILCOS: ST-250-H/I-E39-59/248 (with internal starting device)

Nominal wattage W	Circuit	Cap	Bulb
250	With internal or external ignitor	E39	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
67	143	149	59	248	3

Starting and warm-up characteristics				
		Rated	Minimum	Maximum
Starting for internal ignitors				
Test voltage (r.m.s.)	V	-	-	198
Starting time	s	-	-	5
Starting for external ignitors				
Test voltage (r.m.s.)	V	-	-	198
Starting time	s	-	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)				
Height (peak) A	V	-	-2 200	-2 250
Rise time T_1	μs	-	-	0,100
Duration time T_2 at 50 % of A	μs	-	0,90	1,00
Warm-up				
Test voltage	V	-	-	198
Time required to reach 50 V minimum at lamp terminals	min	-	-	4

[1] Deviation of any point along the centre line of the arc tube from the axis of the cap (apex of the cap eyelet used as the point of reference).

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-250-H/E-E39-59/248 (with external starting device)
ILCOS: ST-250-H/I-E39-59/248 (with internal starting device)

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	250	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	3,0	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	120	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	250	220	3,0	59,0	0,075 ± 0,005

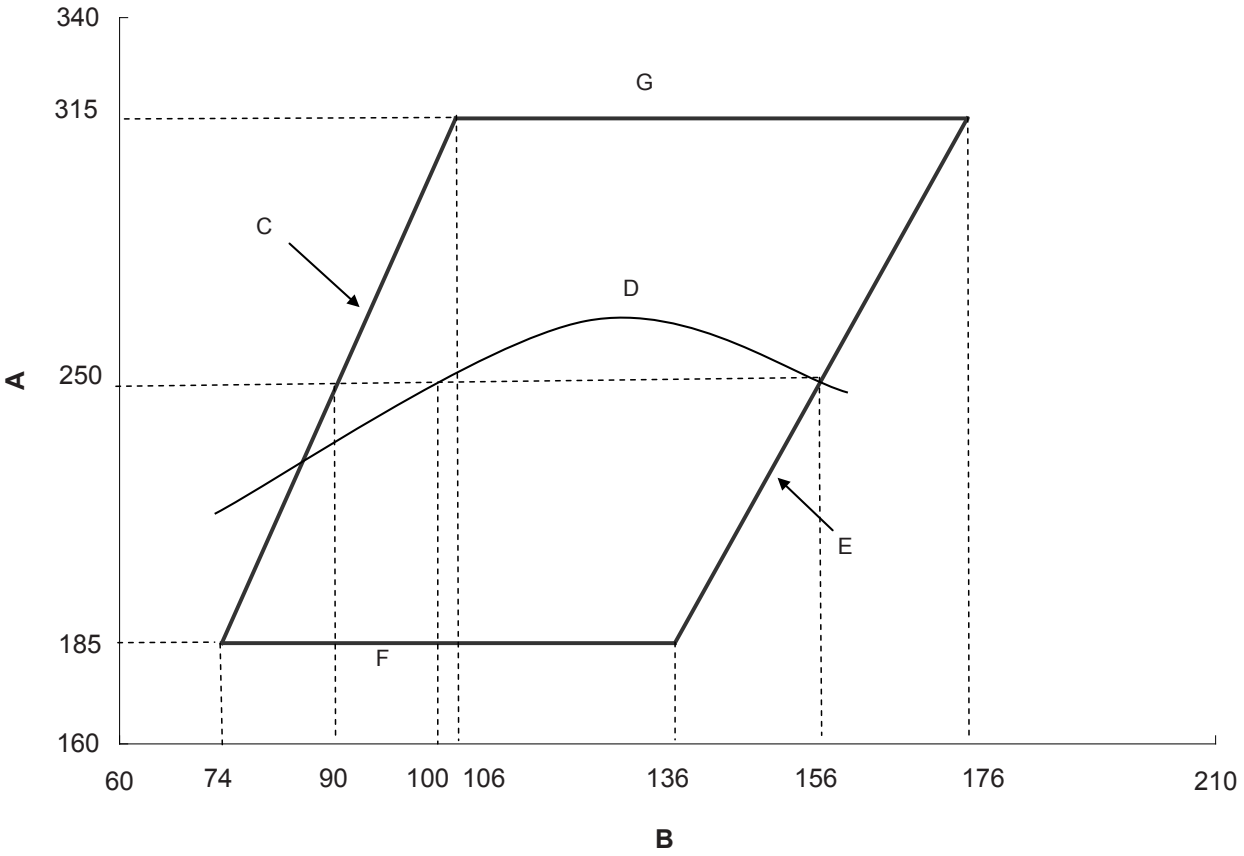
Information for ballast and ignitor design			
		Minimum	Maximum
Open circuit voltage (r.m.s.), lag circuit	V	198	-
Open circuit voltage (r.m.s.), lead circuit	V	198	
Pulse height (peak)	V	-2 500	-
Pulse width	μs	1 at 2 250 V	
Lamp warm-up current (r.m.s.)	A	3,0	4,5
Pulse height (peak), luminaire requirement	V	-	-4 000
Current off time at maximum short-circuit current	ms		2,5
Current off time at nominal lamp operating current	ms		2,0

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-250-H/E-E39-59/248 (with external starting device)
ILCOS: ST-250-H/I-E39-59/248 (with internal starting device)



A typical ballast characteristic curve at rated supply voltage is shown by line D in the diagram.

Key
A Lamp wattage (W)
B Lamp voltage (V)
C Minimum lamp voltage (V)
D Ballast characteristic curve
E Maximum lamp voltage (V)
F Minimum lamp wattage (W)
G Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: ST-250-H/E-E39-52/250

Nominal wattage W	Circuit	Cap	Bulb
250	With external ignitor	E39	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
65	155	165	52	250	3

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	180
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	2 475	2 500
Duration time T_2 at 90 % of A	µs	-	1,00
Repetition rate		1/half cycle	
Position (phase angle)	°	60~90, 240~270	
Warm-up			
Test voltage	V		180
Time required to reach 47,5 V minimum at lamp terminals	min	-	5

[1] Deviation of any point along the centre line of the arc tube from the axis of the cap (apex of the cap eyelet used as the point of reference).

[2] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-250-H/E-E39-52/250

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	247	-	-
Voltage (r.m.s.) at lamp terminals	V	95	70	115
Current (r.m.s.)	A	3,1	2,65	3,55
Extinguishing voltage r.m.s. (see 8.6)	V	116	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	250	200	3,1	51,5 ± 0,5 %	0,053 ± 0,008
60	250	200	3,1	51,5 ± 0,5 %	0,053 ± 0,008

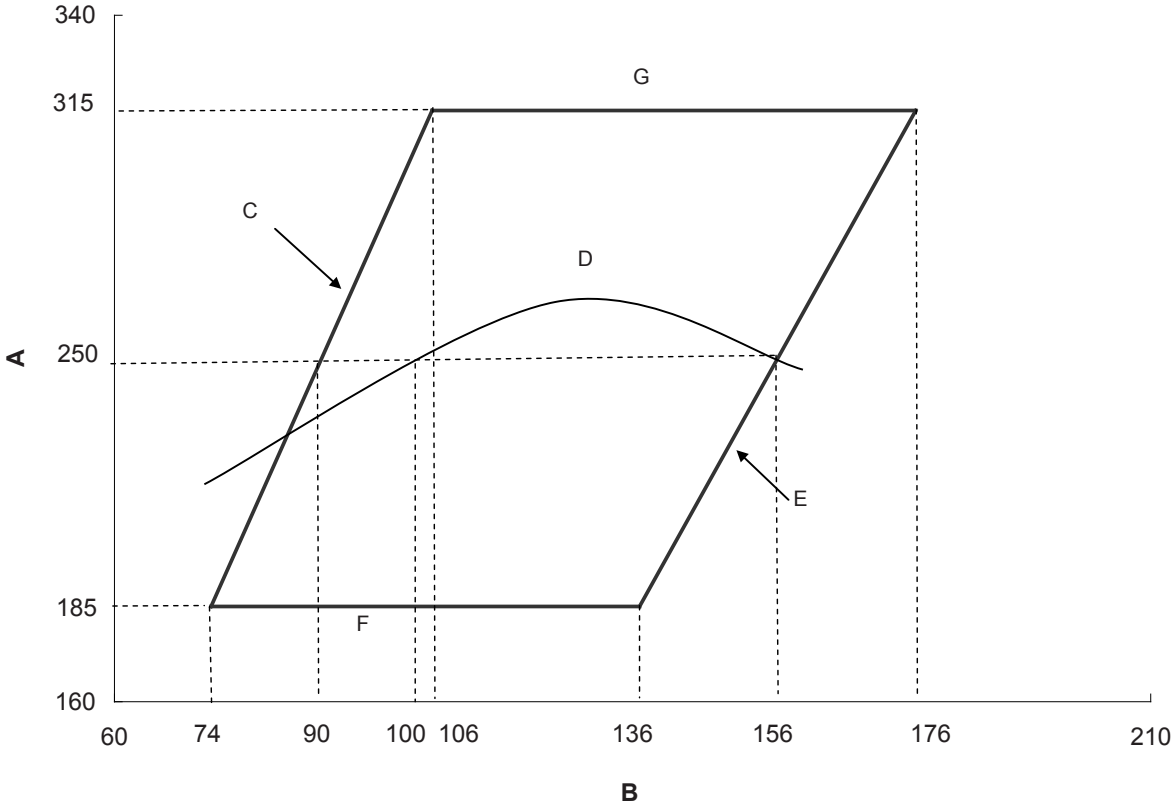
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	3,1	5,58
Pulse height (peak), luminaire requirement	V	2 700	4 500

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-250-H/E-E39-52/250



A typical ballast characteristic curve at rated supply voltage is shown by line D in the diagram.

Key
A Lamp wattage (W)
B Lamp voltage (V)
C Minimum lamp voltage (V)
D Ballast characteristic curve
E Maximum lamp voltage (V)
F Minimum lamp wattage (W)
G Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: SE-250-H/E-E40-91/227 (with external starting device)
ILCOS: SE-250-H/I-E40-91/227 (with internal starting device)

Nominal wattage W	Circuit	Cap	Bulb
250	With internal or external ignitor	E40	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	91	227	-

Starting and warm-up characteristics [1)]			
		Rated	Maximum
Starting for internal ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	90*
*From switch on, value under consideration.			
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle)	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	5

[1)] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-250-H/E-E40-91/227 (with external starting device)
ILCOS: SE-250-H/I-E40-91/227 (with internal starting device)

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	250	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	3,0	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	120	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	250	220	3,0	60,0	0,06 ± 0,005

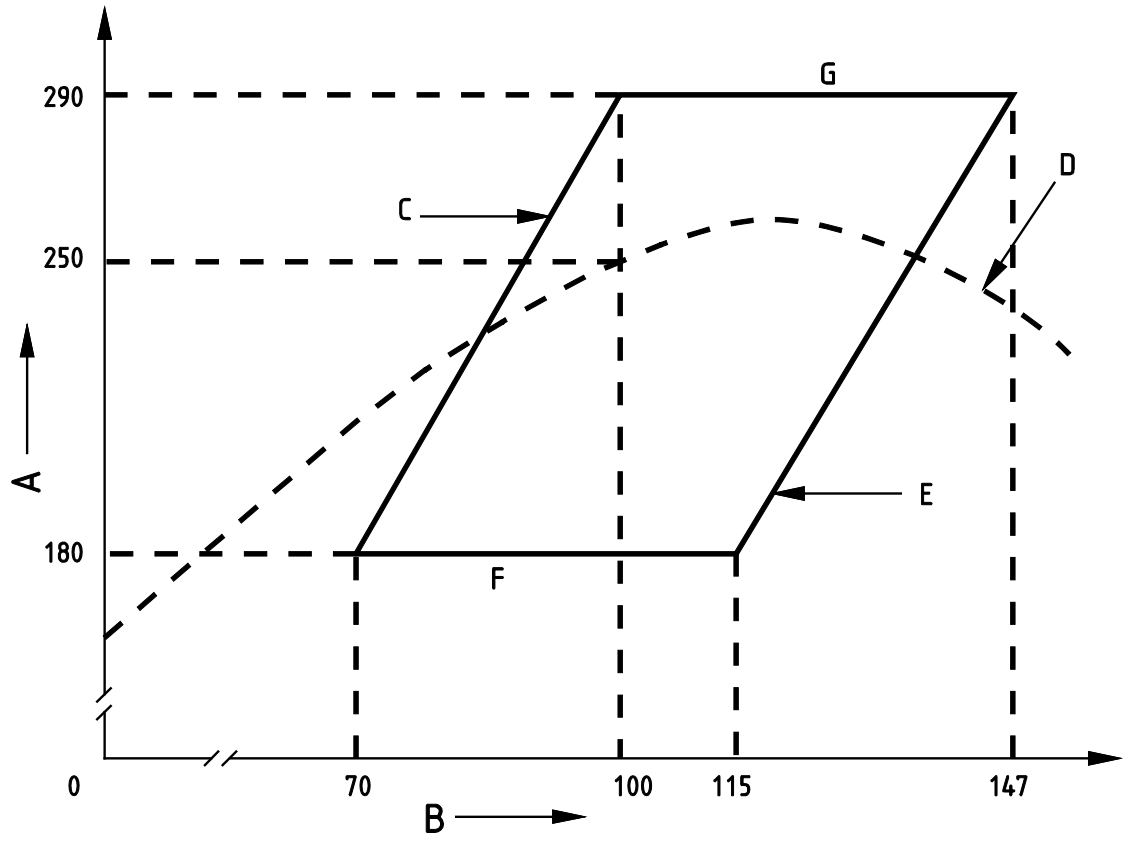
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	3,0	5,2
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-250-H/E-E40-91/227 (with external starting device)
ILCOS: SE-250-H/I-E40-91/227 (with internal starting device)



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: SE-250-H/E-E39-91/227 (with external starting device)
ILCOS: SE-250-H/I-E39-91/227 (with internal starting device)

Nominal wattage W	Circuit	Cap	Bulb
250	With internal or external ignitor	E39	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	91	227	-

Starting and warm-up characteristics				
		Rated	Minimum	Maximum
Starting for internal ignitors				
Test voltage (r.m.s.)	V	-	-	198
Starting time	s	-	-	5
Starting for external ignitors				
Test voltage (r.m.s.)	V	-	-	198
Starting time	s	-	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)				
Height (peak) A	V	-	-2 200	-2 250
Rise time T_1	μs	-	-	0,100
Duration time T_2 at 50 % of A	μs	-	0,90	1,00
Warm-up				
Test voltage	V	-	-	198
Time required to reach 50 V minimum at lamp terminals	min	-	-	4

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-250-H/E-E39-91/227 (with external starting device)
ILCOS: SE-250-H/I-E39-91/227 (with internal starting device)

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	250	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	3,0	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	120	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	250	220	3,0	59,0	0,075 ± 0,005

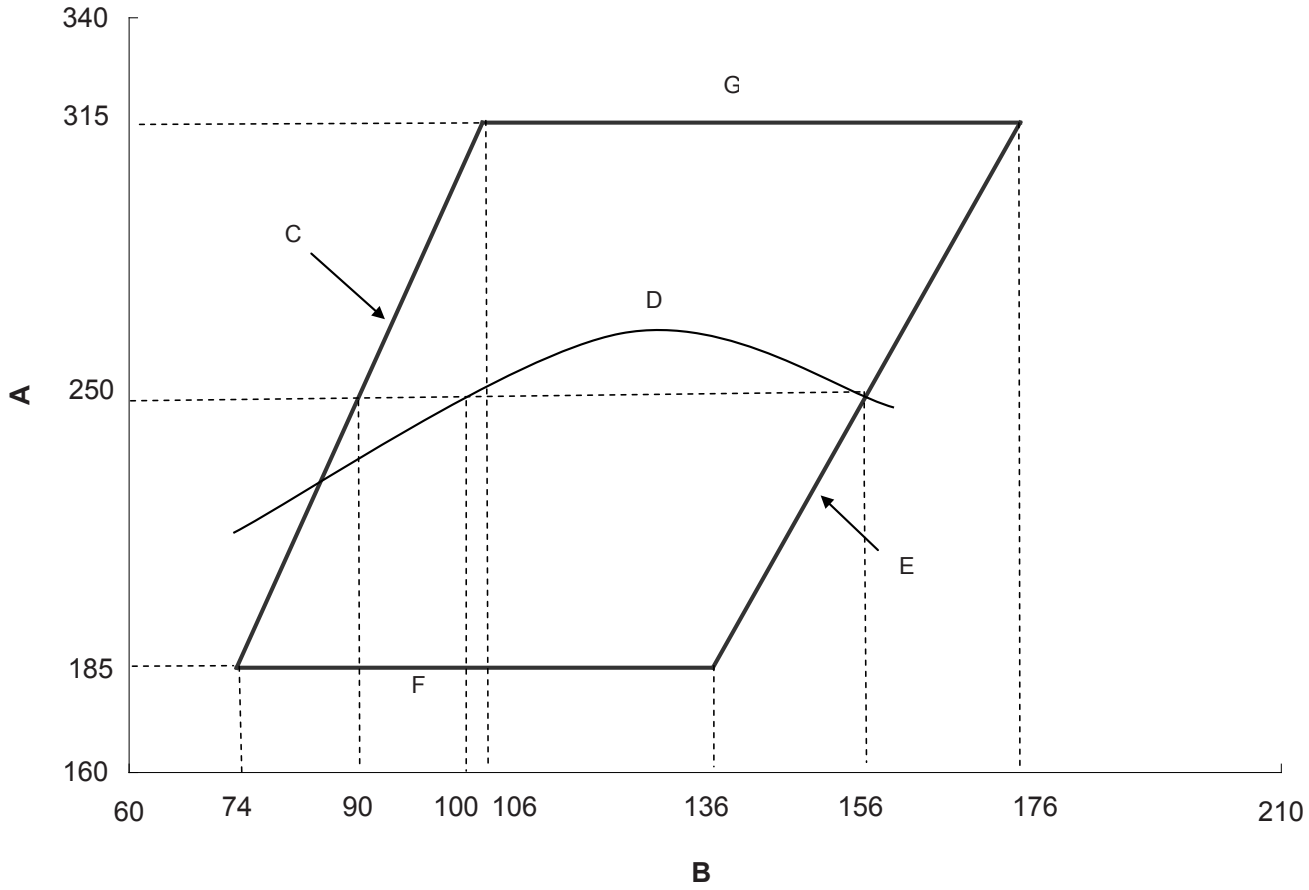
Information for ballast and ignitor design			
		Minimum	Maximum
Open circuit voltage (r.m.s.), lag circuit	V	198	-
Open circuit voltage (r.m.s.), lead circuit	V	198	
Pulse height (peak)	V	-2 500	-
Pulse width	μs	1 at 2 250 V	
Lamp warm-up current (r.m.s.)	A	3,0	4,5
Pulse height (peak), luminaire requirement	V	-	-4 000
Current off time at maximum short-circuit current	ms		2,5
Current off time at nominal lamp operating current	ms		2,0

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-250-H/E-E39-91/227 (with external starting device)
ILCOS: SE-250-H/I-E39-91/227 (with internal starting device)



A typical ballast characteristic curve at rated supply voltage is shown by line D in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 1

ILCOS: STM-250-H/E-E40-48/260

Nominal wattage W	Circuit	Cap	Bulb
250	With external ignitor	E40	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
50	153	163	48	260	3

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

[2] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 2

ILCOS: STM-250-H/E-E40-48/260

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	245	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85 [1)]	115 [1)]
Current (r.m.s.)	A	2,95	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	120	-	-

[1)] at input voltage

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 170
Chromaticity co-ordinates x/y (nominal)		0,510/0,420
Colour rendering index R_a (nominal)		≥60

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	250	220	3,0	60,0	0,06 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	3,0	5,2
Pulse height (peak), luminaire requirement	V	-	5 000

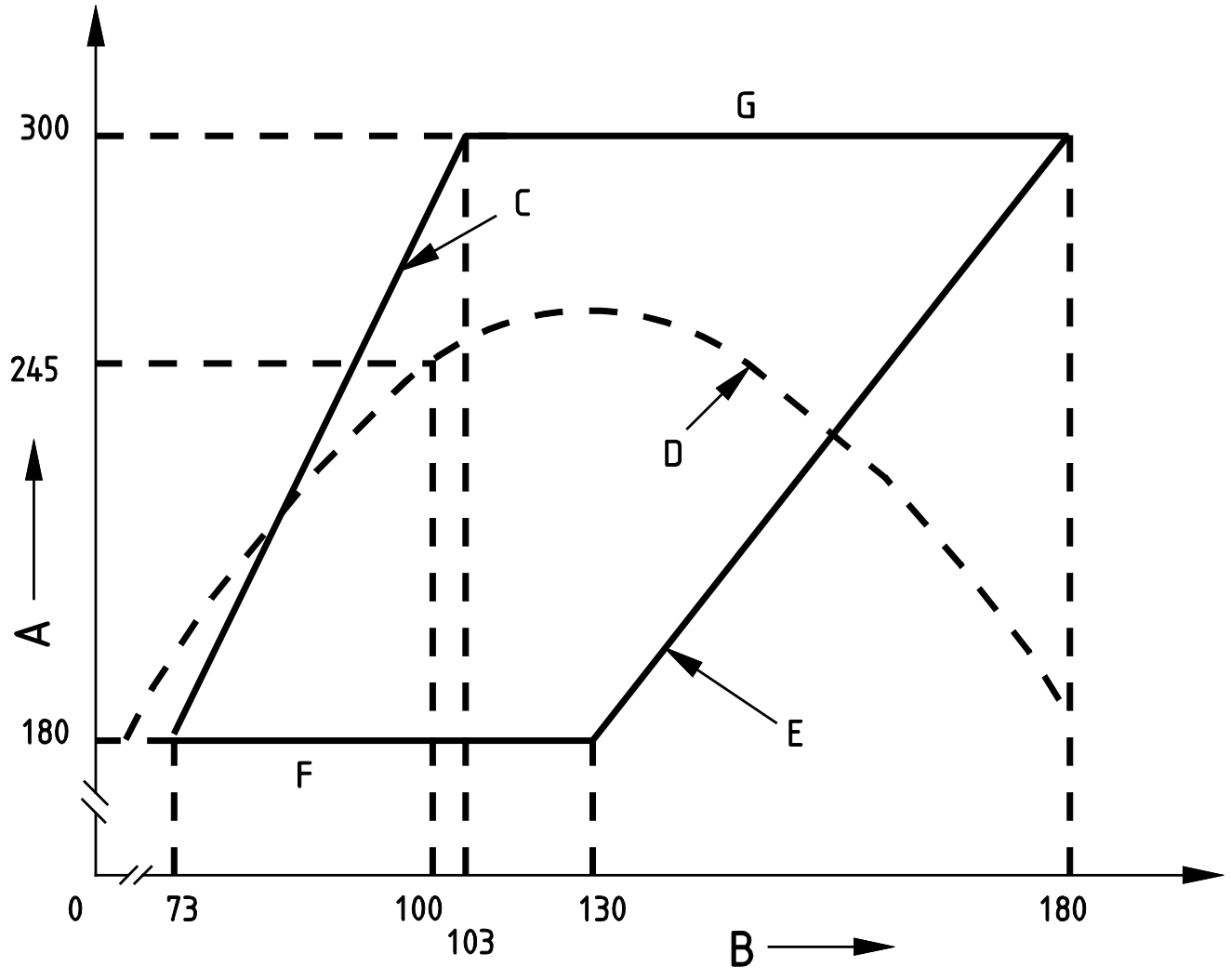
Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 3

ILCOS: STM-250-H/E-E40-48/260



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 1

ILCOS: STM-250-H/E-E39-59/248

Nominal wattage W	Circuit	Cap	Bulb
250	With external ignitor	E39	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
47	143	149	59	248	3

Starting and warm-up characteristics			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)			
Height (peak) A	V	-2 200	-2 250
Rise time T_1	μs	-	0,100
Duration time T_2 at 50 % of A	μs	0,90	1,00
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 2

ILCOS: STM-250-H/E-E39-59/248

Electrical characteristics						
		Rated	Minimum		Maximum	
Wattage	W	245	-		-	
Voltage (r.m.s.) at lamp terminals	V	100	77 [1]	90 [2]	130 [1]	120 [2]
Current (r.m.s.)	A	2,95	-		-	
Extinguishing voltage r.m.s. (see 8.6)	V	120	-		-	

[1] at input voltage; [2] at set input wattage
Only one method of how to obtain the lamp voltage shall be used and stated as such.

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 170
Chromaticity co-ordinates x/y (nominal)		0,510/0,420
Colour rendering index R_a (nominal)		≥60

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	250	220	3,0	59,0	0,075 ± 0,005

Information for ballast and ignitor design [1]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	3,0	5,2
Pulse height (peak), luminaire requirement	V	-	4 000
Current off time at maximum short-circuit current	ms		2,5
Current off time at nominal lamp operating current	ms		2,0

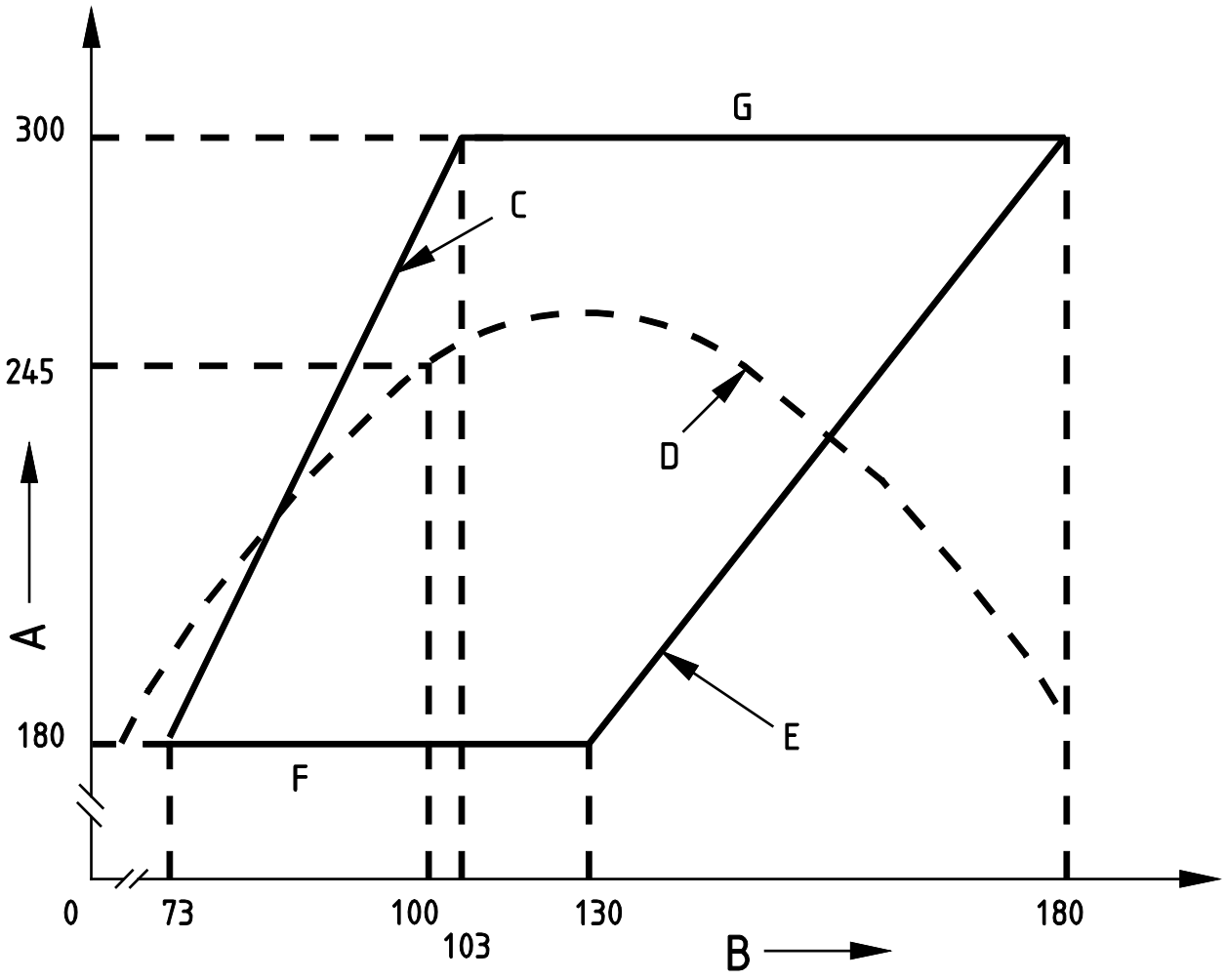
Lamp operating limits are shown graphically on page 3.

[1] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 3

ILCOS: STM-250-H/E-E39-59/248



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 1

ILCOS: SEM-250-H/E-E40-91/227

Nominal wattage W	Circuit	Cap	Bulb
250	With external ignitor	E40	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	91	227	-

Starting and warm-up characteristics [1)]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

[1)] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 2

ILCOS: SEM-250-H/E-E40-91/227

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	245	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	2,95	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	120	-	-

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 170
Chromaticity co-ordinates x/y (nominal)		0,510/0,420
Colour rendering index R_a (nominal)		≥60

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	250	220	3,0	60,0	0,06 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	3,0	5,2
Pulse height (peak), luminaire requirement	V	-	5 000

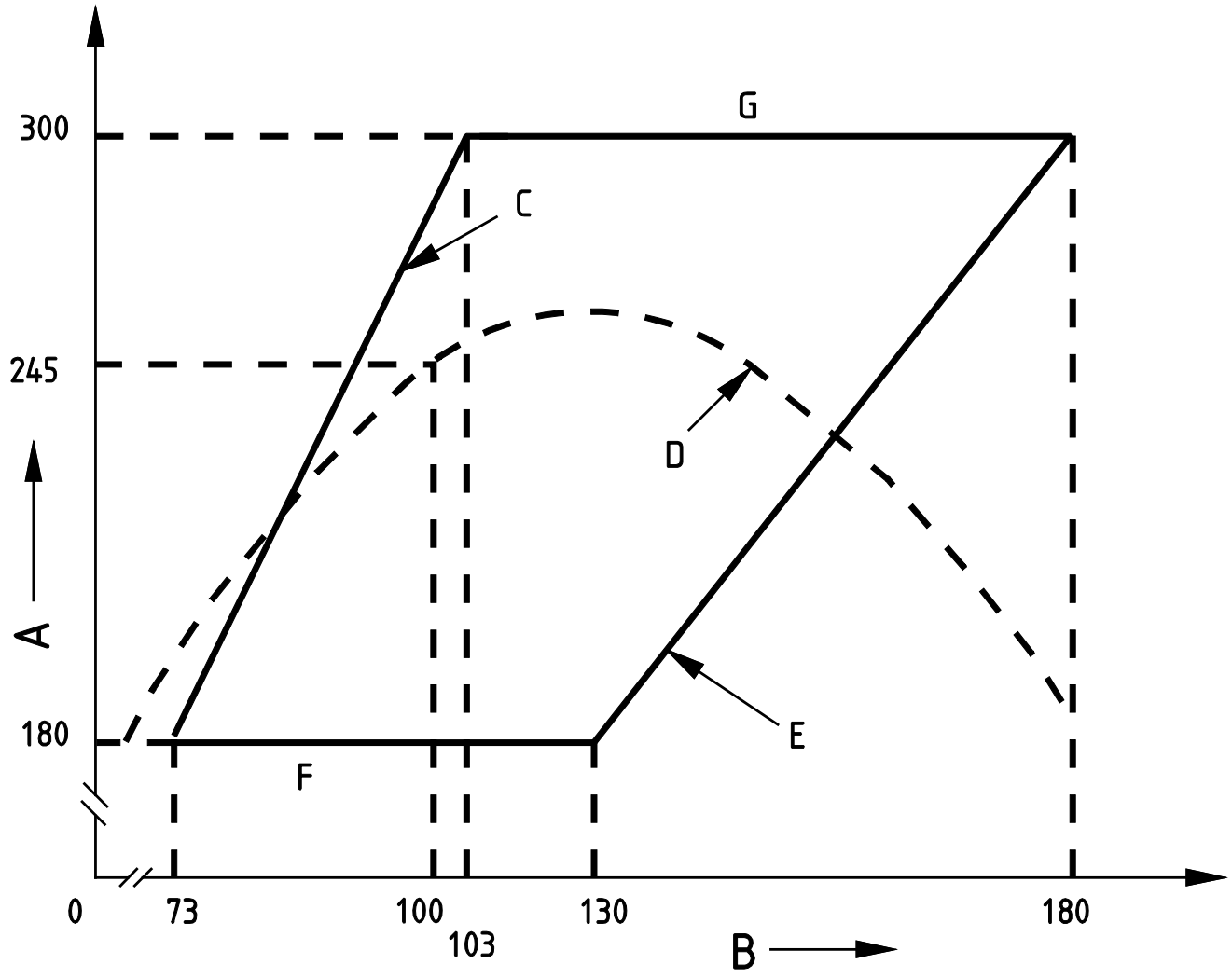
Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	7
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 3

ILCOS: SEM-250-H/E-E40-91/227



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 1

ILCOS: SEM-250-H/E-E39-91/227

Nominal wattage W	Circuit	Cap	Bulb
250	With external ignitor	E39	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	91	227	-

Starting and warm-up characteristics			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)			
Height (peak) A	V	-2 200	-2 250
Rise time T_1	μs	-	0,100
Duration time T_2 at 50 % of A	μs	0,90	1,00
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 2

ILCOS: SEM-250-H/E-E39-91/227

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	245	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	2,95	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	120	-	-

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 170
Chromaticity co-ordinates x/y (nominal)		0,510/0,420
Colour rendering index R_a (nominal)		≥60

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	250	220	3,0	59,0	0,075 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	3,0	5,2
Pulse height (peak), luminaire requirement	V	-	4 000

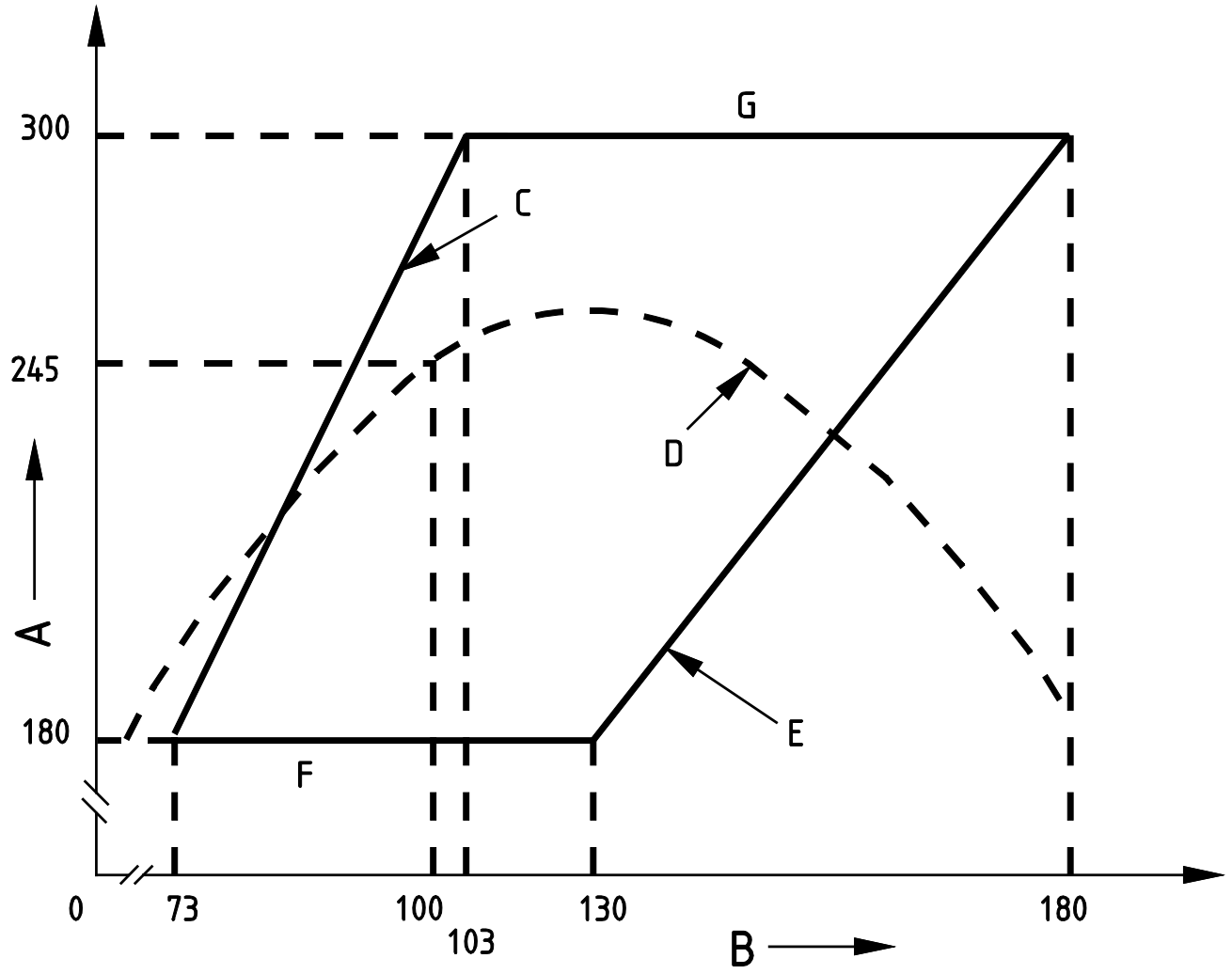
Lamp operating limits are shown graphically on page 3.

[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	7
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 3

ILCOS: SEM-250-H/E-E39-91/227



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **(with high colour rendering)** **DATA SHEET**	Page 1

ILCOS: SEH-250-H/I-E39-102/250

Nominal wattage W	Circuit	Cap	Bulb
250	With internal ignitor	E39	Elliptical - clear or diffuse coating

Dimensions (see Annex B)					
A* mm	C* mm		D mm	L mm	Deviation [1)] °
Nominal	Min.	Max.	Max.	Max.	Max.
41	155	165	102	250	3

* For clear bulb types

Starting and warm-up characteristics			
		Rated	Maximum
Starting for internal ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time after the internal starter has opened	s	-	60*

*From switch on

Warm-up			
Test voltage	V		220
Time required to reach 50 V minimum at lamp terminals	min	-	10

[1)] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference), applicable to clear lamps

	HIGH PRESSURE SODIUM VAPOUR LAMPS (with high colour rendering) DATA SHEET	Page 2

ILCOS: SEH-250-H/I-E39-102/250

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	250	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	110
Current (r.m.s.)	A	3,1	2,77	3,50
Extinguishing voltage r.m.s. (see 8.6)	V	130*	-	-

* under consideration

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 500
Chromaticity co-ordinates x/y (nominal)		0,478/0,415
Colour rendering index R_a (nominal)		85

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50 or 60	250	220	3,1	54,7	0,075 ± 0,005

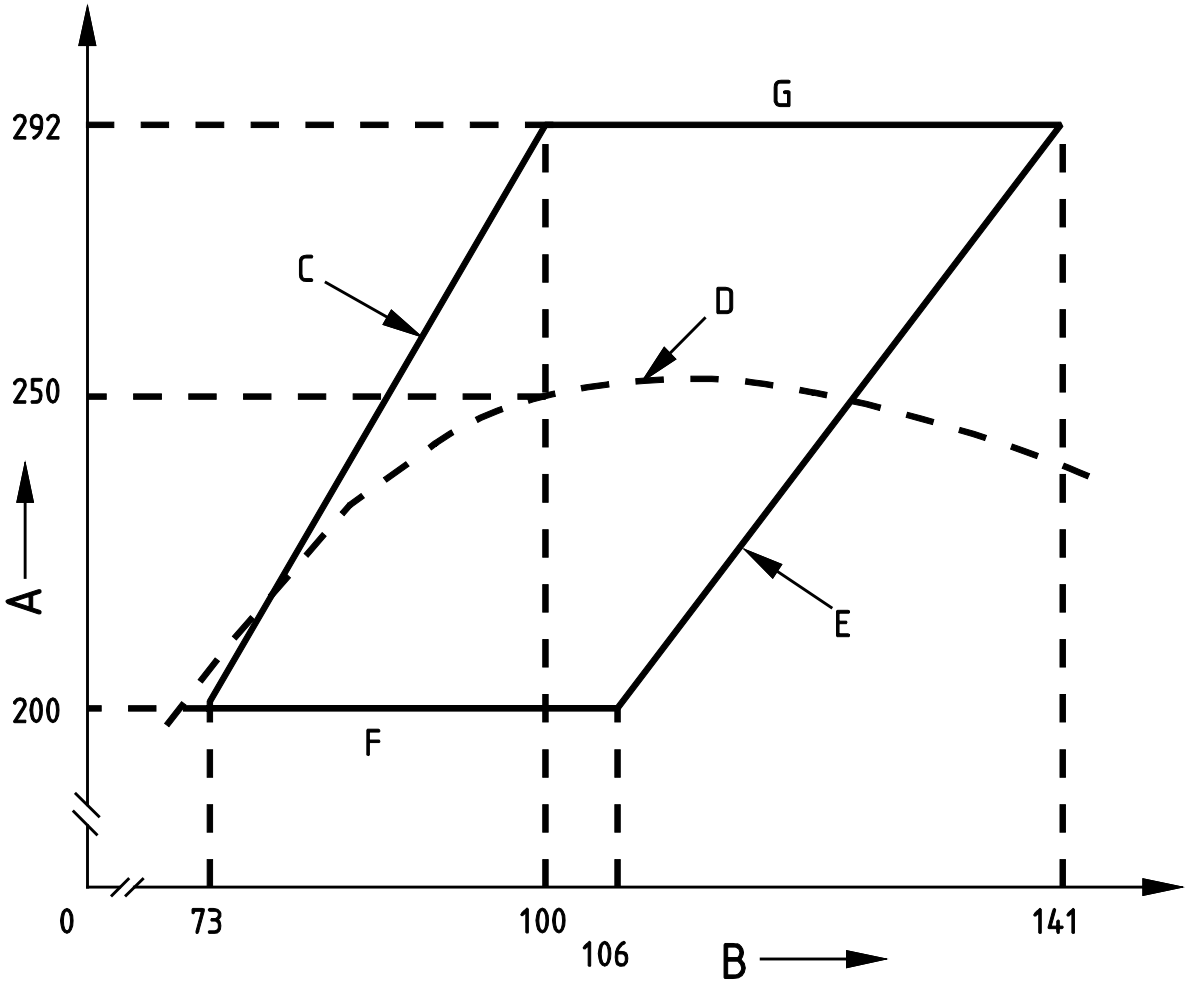
Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	3,1	5,2
Pulse height (peak), luminaire requirement	V	-	4 500

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS (with high colour rendering) DATA SHEET	Page 3

ILCOS: SEH-250-H/I-E39-102/250



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 1

ILCOS: ST-250-H/S-E40-48/260

Nominal wattage W	Circuit	Cap	Bulb
250	With external ignitor	E40	Tubular - clear

Dimensions (see Annex B)					
A* mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
65	153	163	48	260	3

* There are presently designs with a nominal arc length of 85 mm.

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	5

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

[2] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 2

ILCOS: ST-250-H/S-E40-48/260

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	255	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	2,95	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	120	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	250	220	3,0	60,0	0,06 ± 0,005

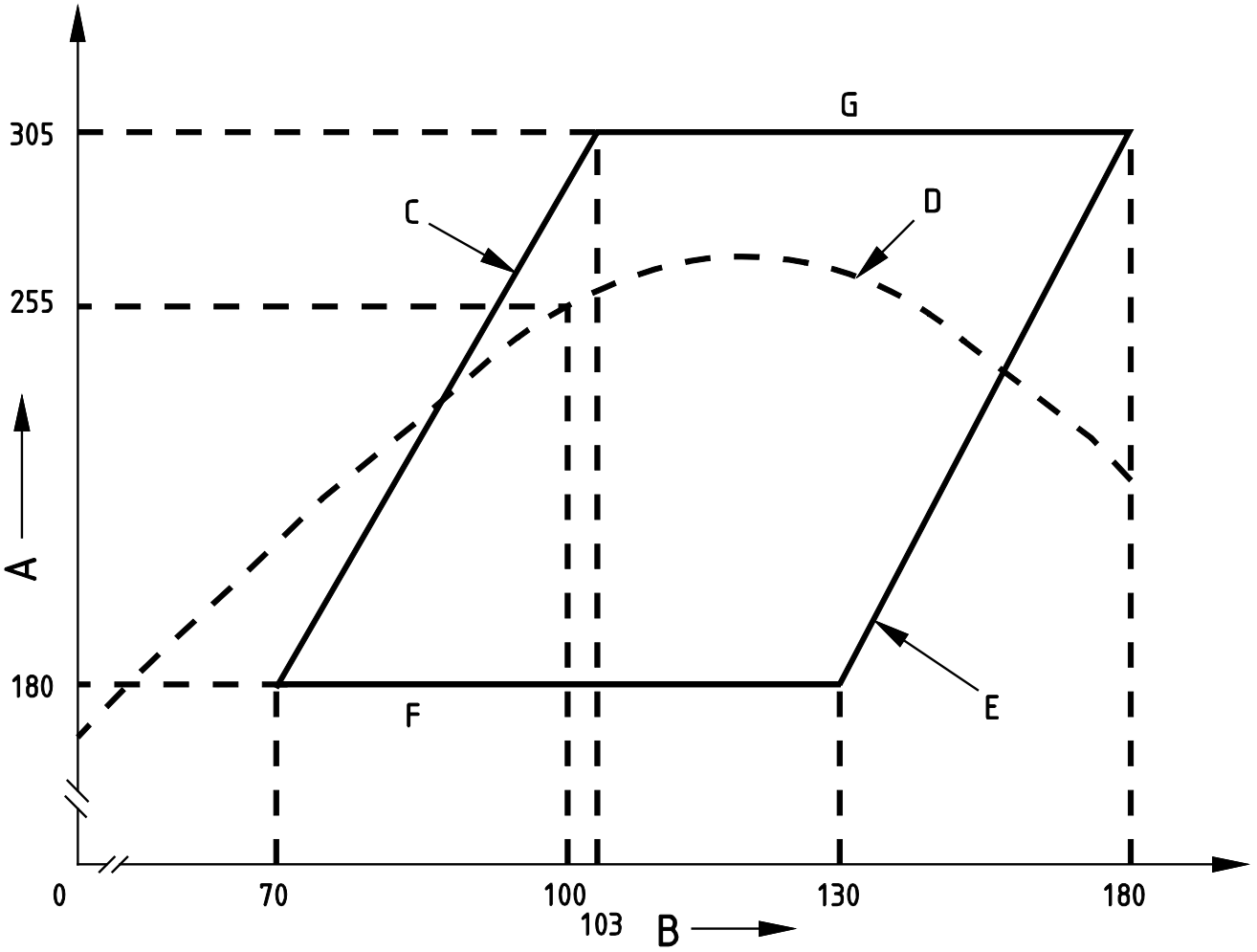
Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	2,95	5,2
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 3

ILCOS: ST-250-H/S-E40-48/260



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 1

ILCOS: SE-250-H/S-E40-91/227

Nominal wattage W	Circuit	Cap	Bulb
250	With external ignitor	E40	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	91	227	-

Starting and warm-up characteristics [1)]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	5

[1)] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 2

ILCOS: SE-250-H/S-E40-91/227

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	255	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	2,95	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	120	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	250	220	3,0	60,0	0,06 ± 0,005

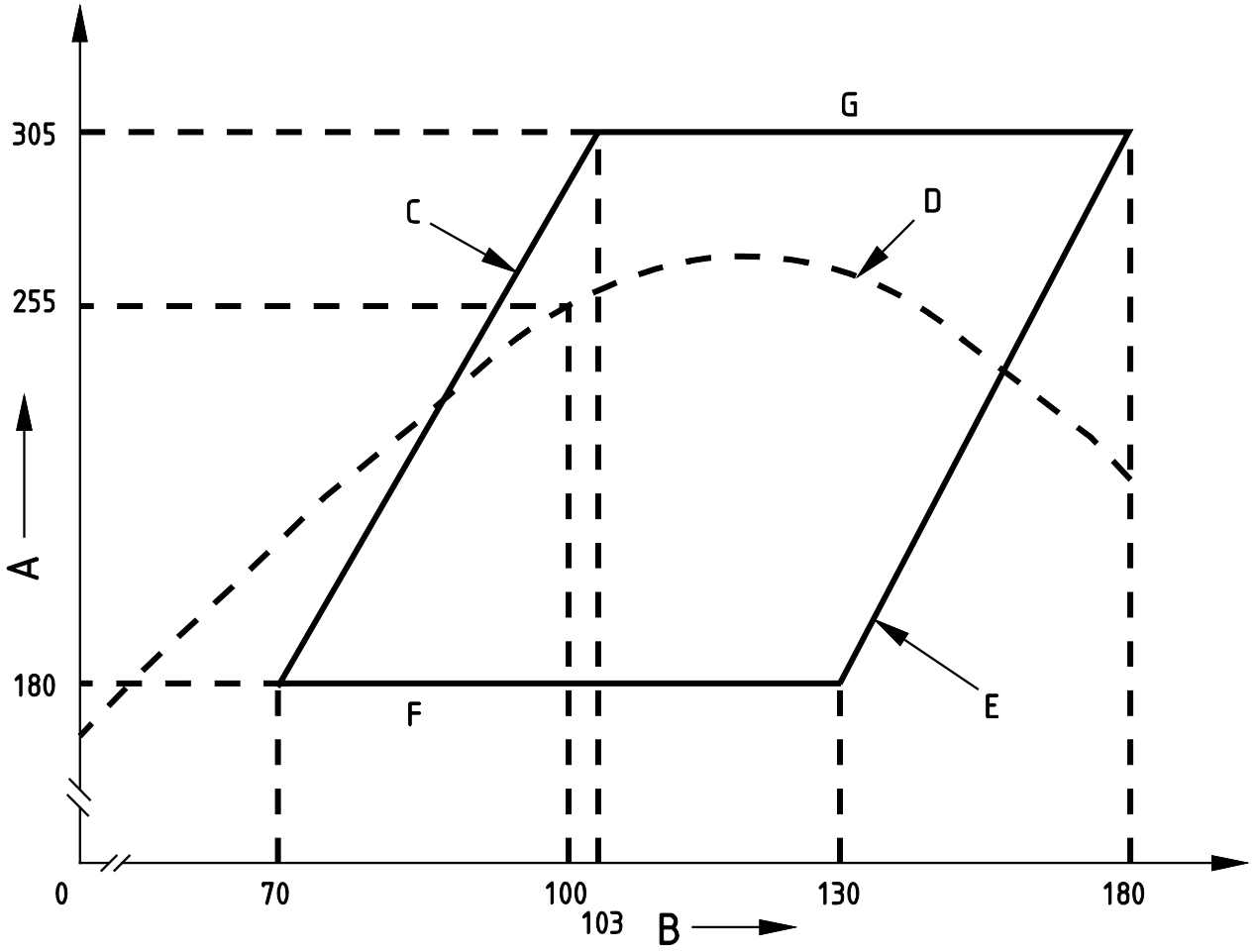
Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	2,95	5,2
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 3

ILCOS: SE-250-H/S-E40-91/227



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: ST-400-H/E-E40-48/292 (with external starter)
ILCOS: ST-400-H/I-E40-48/292 (with internal starter)

Nominal wattage W	Circuit	Cap	Bulb
400	With internal or external ignitor	E40	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
85	170	180	48	292	3

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for internal ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	60*
*From switch on, value under consideration.			
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle)	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	4

[1] Deviation of any point along the centre line of the arc tube from the axis of the cap (apex of the cap eyelet used as the point of reference)

[2] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-400-H/E-E40-48/292 (with external starter)
ILCOS: ST-400-H/I-E40-48/292 (with internal starter)

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	392	-	-
Voltage (r.m.s.) at lamp terminals	V	100	74	117
Current (r.m.s.)	A	4,6	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	125	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	400	220	4,6	39,0	0,06 ± 0,005

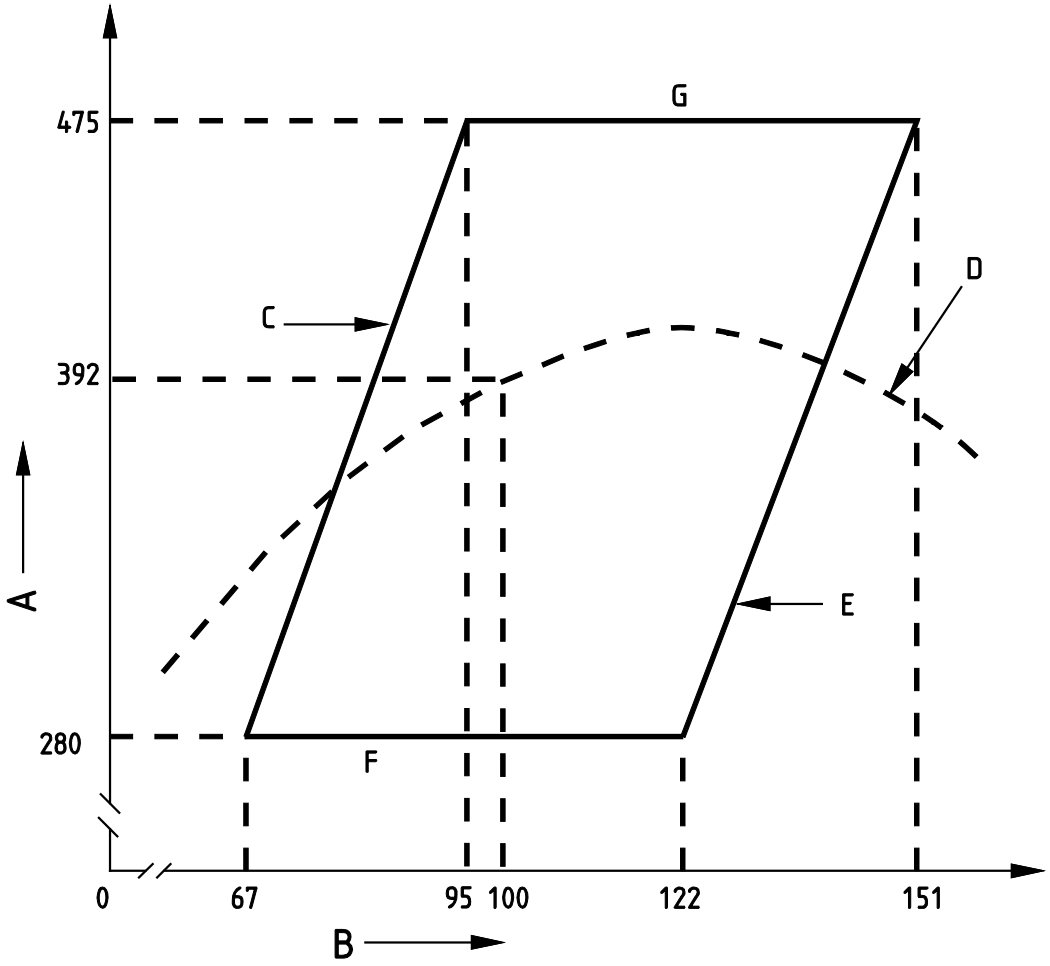
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	4,6	7,5
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	12
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-400-H/E-E40-48/292 (with external starter)
ILCOS: ST-400-H/I-E40-48/292 (with internal starter)



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: ST-400-H/E-E39-59/248 (with external starter)
ILCOS: ST-400-H/I-E39-59/248 (with internal starter)

Nominal wattage W	Circuit	Cap	Bulb
400	With internal or external ignitor	E39	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
75	143	149	59	248	3

Starting and warm-up characteristics				
		Rated	Minimum	Maximum
Starting for internal ignitors				
Test voltage (r.m.s.)	V	-	-	198
Starting time	s	-	-	5
Starting for external ignitors				
Test voltage (r.m.s.)	V	-	-	198
Starting time	s	-	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)				
Height (peak) A	V	-	-2 200	-2 250
Rise time T_1	µs	-	-	0,100
Width T_2 at 50 % of A	µs	-	0,90	1,00
Warm-up				
Test voltage	V	-	-	198
Time required to reach 50 V minimum at lamp terminals	min	-	-	4

[1] Deviation of any point along the centre line of the arc tube from the axis of the cap (apex of the cap eyelet used as the point of reference)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-400-H/E-E39-59/248 (with external starter)
ILCOS: ST-400-H/I-E39-59/248 (with internal starter)

Electrical characteristics						
		Rated	Minimum		Maximum	
Wattage	W	392	-		-	
Voltage (r.m.s.) at lamp terminals	V	100	74 [1)]	84 [2)]	117 [1)]	115 [2)]
Current (r.m.s.)	A	4,6	-		-	
Extinguishing voltage r.m.s. (see 8.6)	V	125	-		-	

[1)] at input voltage; [2)] at set input wattage
Only one method of how to obtain the lamp voltage shall be used and stated as such.

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	400	220	4,6	38,6	0,075 ± 0,005

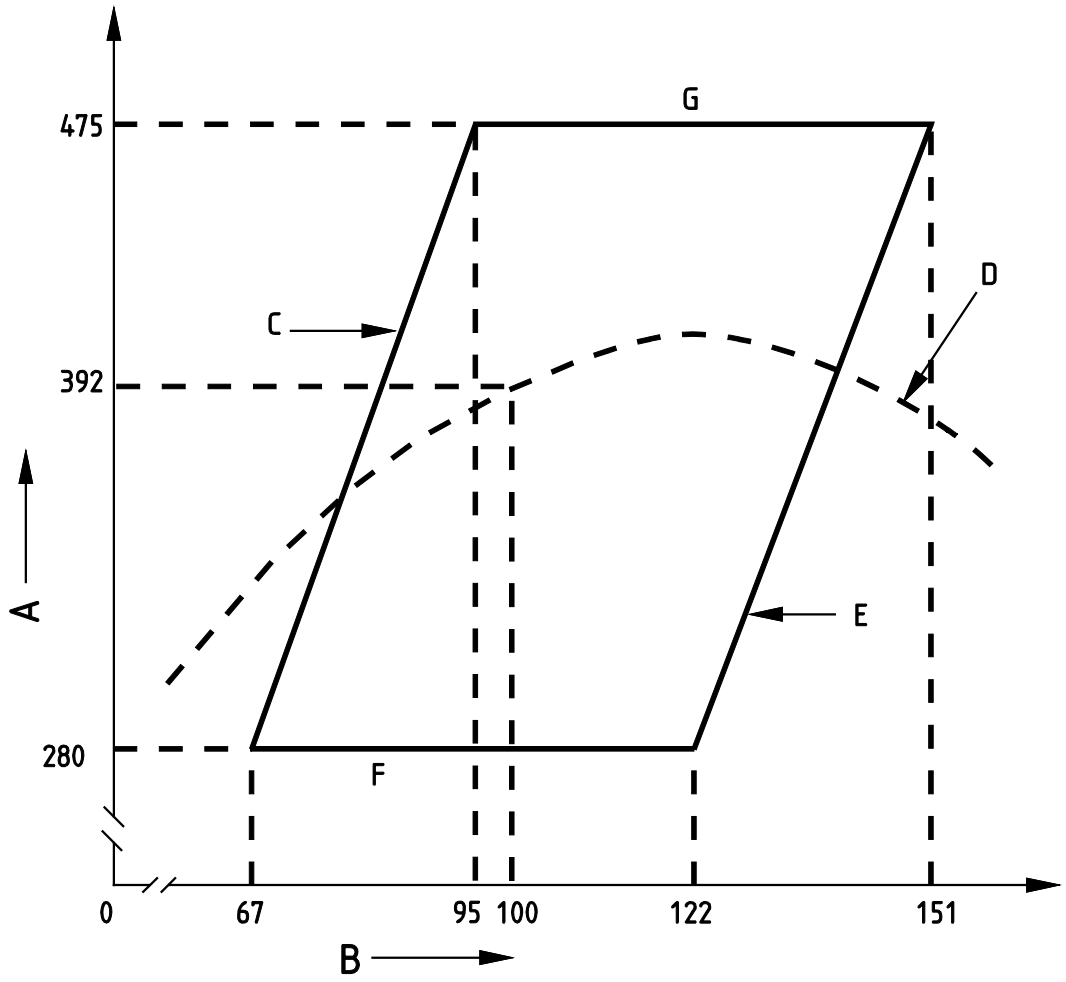
Information for ballast and ignitor design			
		Minimum	Maximum
Open circuit voltage (r.m.s.), lag circuit	V	198	-
Open circuit voltage (r.m.s.), lead circuit	V	198	-
Pulse height (peak)	V	-2 500	-
Pulse width	μs	1 at 2 250 V	
Lamp warm-up current (r.m.s.)	A	4,6	7,5
Pulse height (peak), luminaire requirement	V	-	-4 000
Current off time at maximum short-circuit current	ms		2,5
Current off time at nominal lamp operating current	ms		2,0

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	12
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-400-H/E-E39-59/248 (with external starter)
ILCOS: ST-400-H/I-E39-59/248 (with internal starter)



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: ST-400-H/E-E39-52/295

Nominal wattage W	Circuit	Cap	Bulb
400	With external ignitor	E39	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
84	180	190	52	295	3

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	180
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	2 475	2 500
Duration time T_2 at 90 % of A	μs	-	1,00
Repetition rate		1/half cycle	
Position (phase angle)	°	60~90, 240~270	
Warm-up			
Test voltage	V		180
Time required to reach 50 V minimum at lamp terminals	min	-	4

[1] Deviation of any point along the centre line of the arc tube from the axis of the cap (apex of the cap eyelet used as the point of reference)

[2] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-400-H/E-E39-52/295

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	396	-	-
Voltage (r.m.s.) at lamp terminals	V	100	75	120
Current (r.m.s.)	A	4,7	4,0	5,4
Extinguishing voltage r.m.s. (see 8.6)	V	121	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	400	200	4,7	33,8 ± 0,5 %	0,046 ± 0,006
60	400	200	4,7	33,8 ± 0,5 %	0,046 ± 0,006

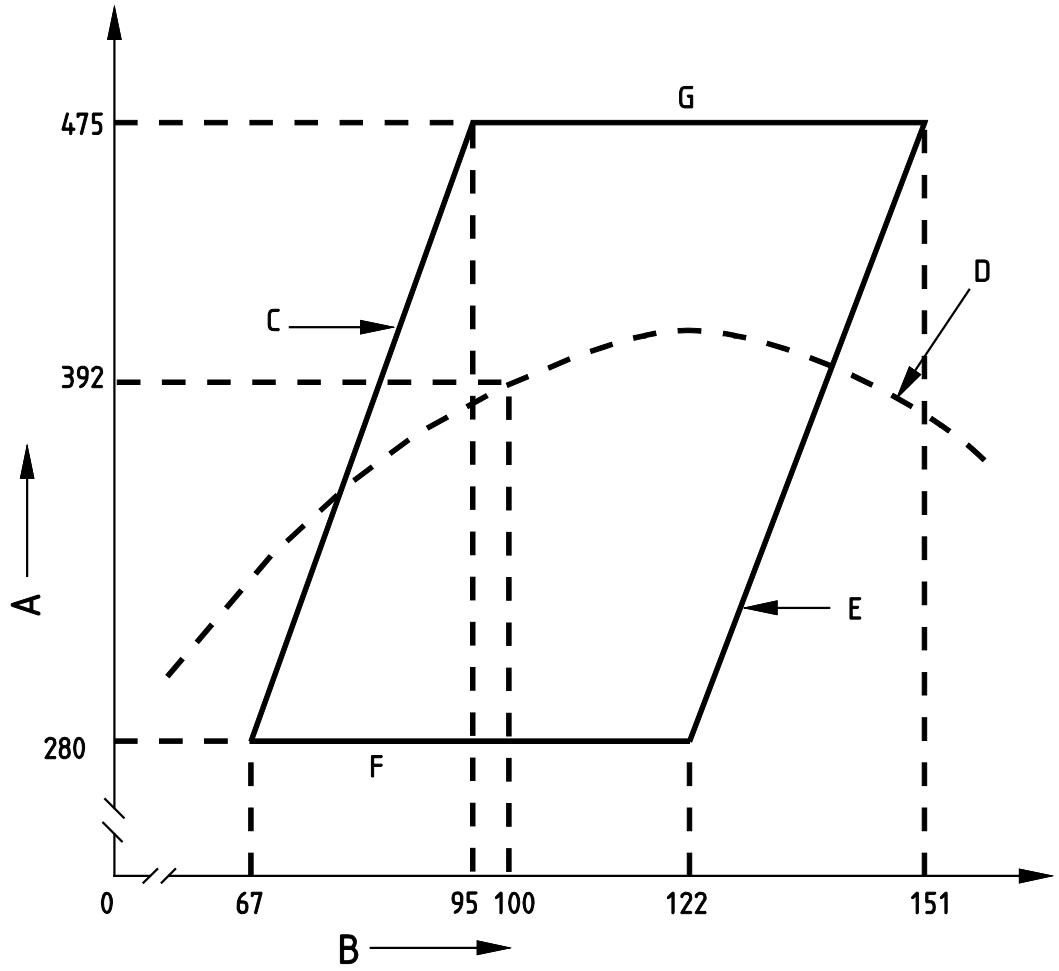
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	4,7	8,46
Pulse height (peak), luminaire requirement	V	2 700	4 500

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	12
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-400-H/E-E39-52/295



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: SE-400-H/E-E40-122/292 (with external starter)
ILCOS: SE-400-H/I-E40-122/292 (with internal starter)

Nominal wattage W	Circuit	Cap	Bulb
400	With internal or external ignitor	E40	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	122	292	-

Starting and warm-up characteristics [1)]			
		Rated	Maximum
Starting for internal ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	60*
*From switch on, value under consideration.			
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	4

[1)] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-400-H/E-E40-122/292 (with external starter)
ILCOS: SE-400-H/I-E40-122/292 (with internal starter)

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	400	-	-
Voltage (r.m.s.) at lamp terminals	V	105	90	120
Current (r.m.s.)	A	4,45	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	125	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	400	220	4,6	39,0	0,06 ± 0,005

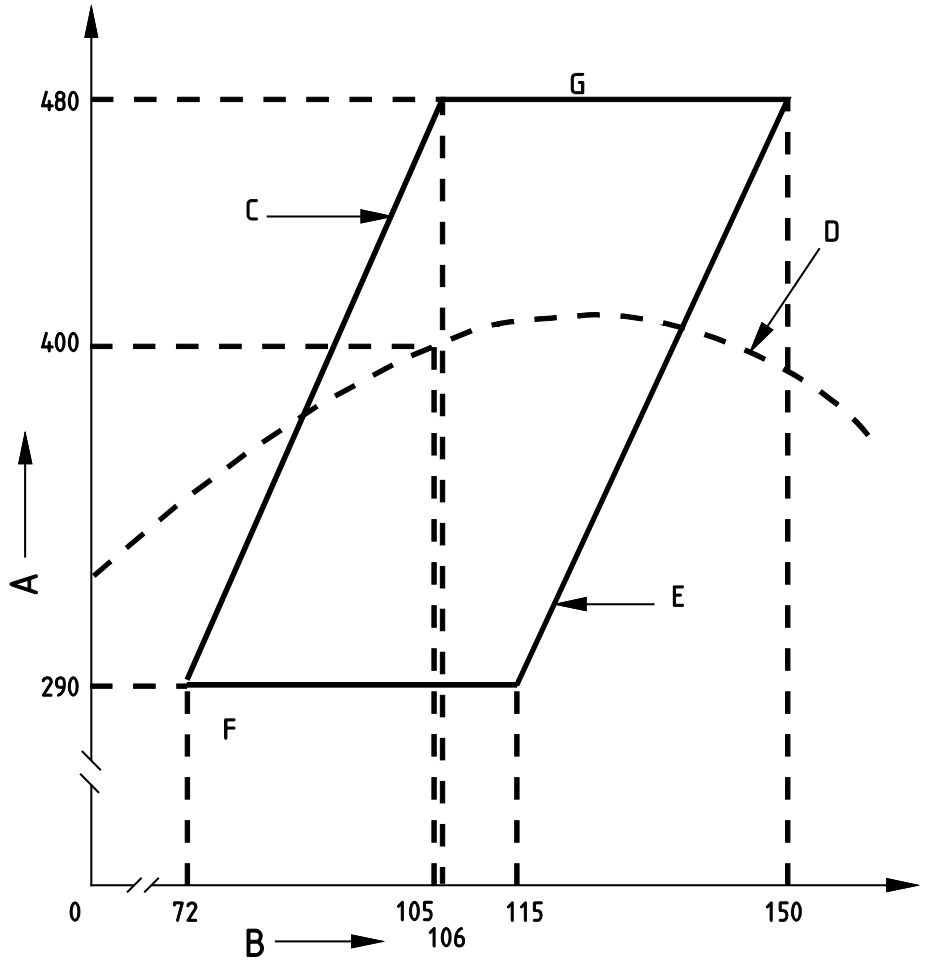
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	4,6	7,5
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	7
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-400-H/E-E40-122/292 (with external starter)
ILCOS: SE-400-H/I-E40-122/292 (with internal starter)



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: SE-400-H/E-E39-122/292 (with external starter)
ILCOS: SE-400-H/I-E39-122/292 (with internal starter)

Nominal wattage W	Circuit	Cap	Bulb
400	With internal or external ignitor	E39	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	122	292	-

Starting and warm-up characteristics				
		Rated	Minimum	Maximum
Starting for internal ignitors				
Test voltage (r.m.s.)	V	-	-	198
Starting time	s	-	-	5
Starting for external ignitors				
Test voltage (r.m.s.)	V	-	-	198
Starting time	s	-	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)				
Height (peak) A	V	-	-2 200	-2 250
Rise time T_1	μs	-	-	0,100
Width T_2 at 50 % of A	μs	-	0,90	1,00
Warm-up				
Test voltage	V	-	-	198
Time required to reach 50 V minimum at lamp terminals	min	-	-	4

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-400-H/E-E39-122/292 (with external starter)
ILCOS: SE-400-H/I-E39-122/292 (with internal starter)

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	400	-	-
Voltage (r.m.s.) at lamp terminals	V	105	90	120
Current (r.m.s.)	A	4,6	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	125	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	400	220	4,6	38,6	0,075 ± 0,005

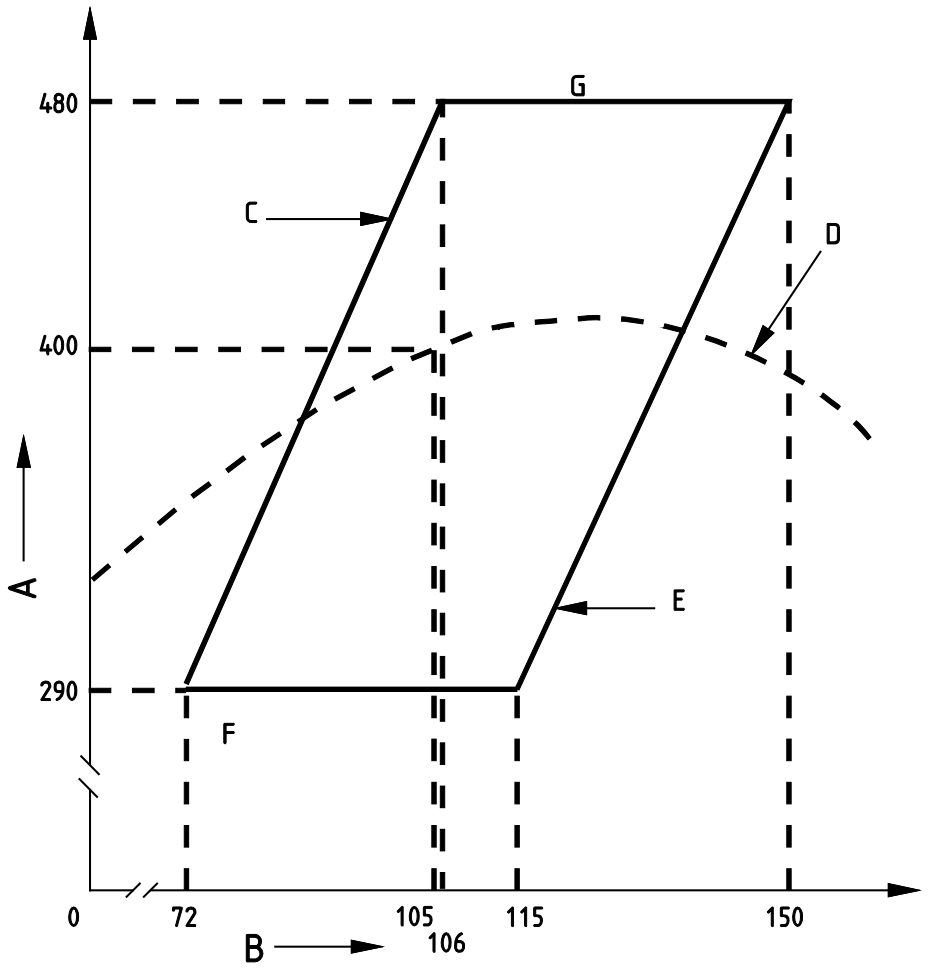
Information for ballast and ignitor design			
		Minimum	Maximum
Open circuit voltage (r.m.s.), lag circuit	V	198	-
Open circuit voltage (r.m.s.), lead circuit	V	198	-
Pulse height (peak)	V	-2 500	-
Pulse width	μs	1 at 2 250 V	
Lamp warm-up current (r.m.s.)	A	4,6	7,5
Pulse height (peak), luminaire requirement	V	-	-4 000

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	7
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-400-H/E-E39-122/292 (with external starter)
ILCOS: SE-400-H/I-E39-122/292 (with internal starter)



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key
A Lamp wattage (W)
B Lamp voltage (V)
C Minimum lamp voltage (V)
D Ballast characteristic curve
E Maximum lamp voltage (V)
F Minimum lamp wattage (W)
G Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 1

ILCOS: STM-400-H/E-E40-48/292

Nominal wattage W	Circuit	Cap	Bulb
400	With external ignitor	E40	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
55	170	180	48	292	3

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

[2] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 2

ILCOS: STM-400-H/E-E40-48/292

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	380	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	4,5	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	125	-	-

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 170
Chromaticity co-ordinates x/y (nominal)		0,510/0,420
Colour rendering index R_a (nominal)		≥60

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	400	220	4,6	39	0,06 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	4,6	7,5
Pulse height (peak), luminaire requirement	V	-	5 000

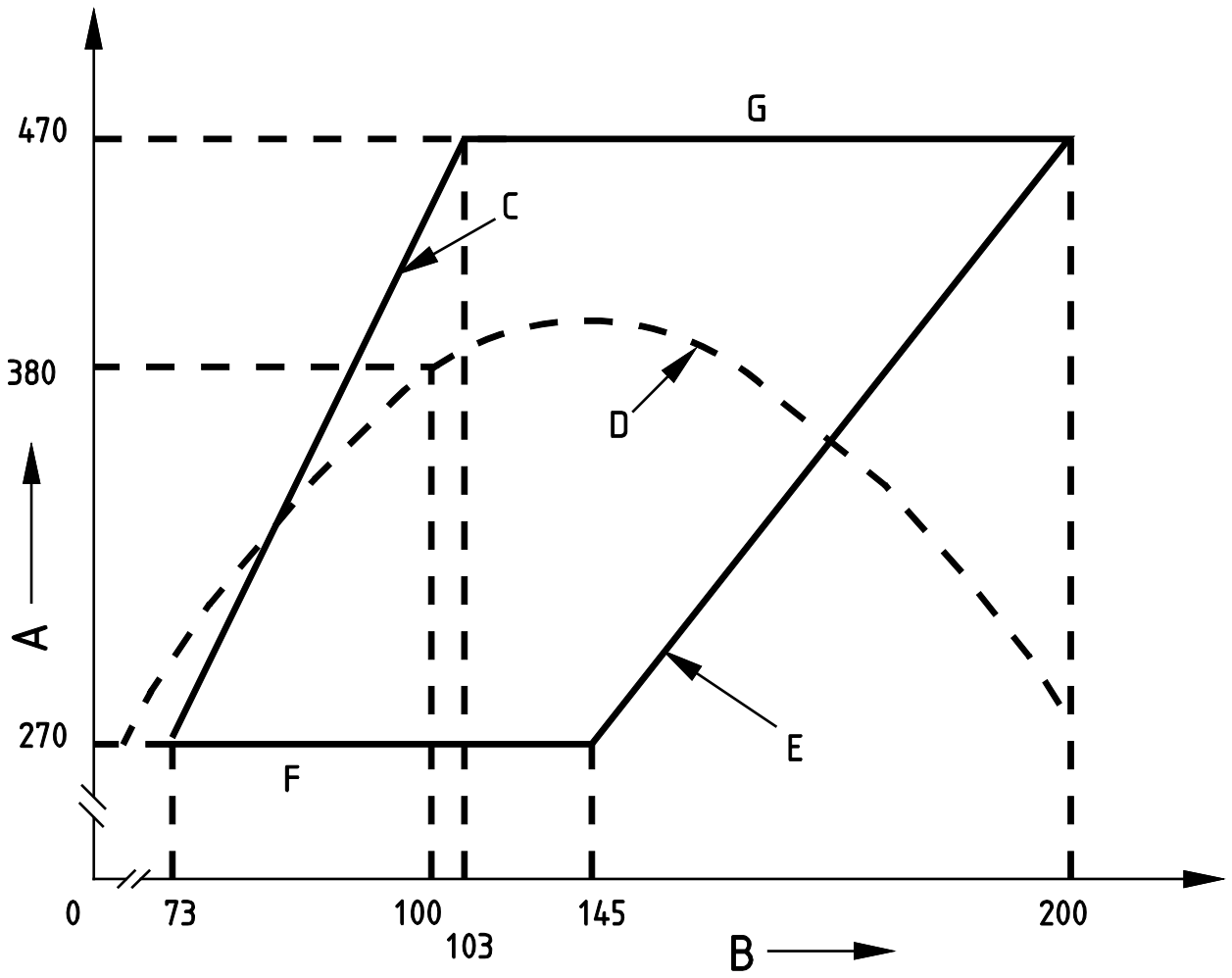
Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	12
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 3

ILCOS: STM-400-H/E-E40-48/292



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 1

ILCOS: ST-400-H/E-E39-59/248

Nominal wattage W	Circuit	Cap	Bulb
400	With external ignitor	E39	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation[1)] °
Nominal	Min.	Max.	Max.	Max.	Max.
57	143	149	59	248	3

Starting and warm-up characteristics			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (see Subclause 9.3 and Annex A, A.2)			
Height (peak) A	V	-2 200	-2 250
Rise time T_1	µs	-	0,100
Duration time T_2 at 50 % of A	µs	0,90	1,00
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

[1)] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 2

ILCOS: STM-400-H/E-E39-59/248

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	380	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	4,5	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	125	-	-

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 170
Chromaticity co-ordinates x/y (nominal)		0,510/0,420
Colour rendering index R_a (nominal)		≥60

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	400	220	4,6	38,6	0,075 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	4,6	7,5
Pulse height (peak), luminaire requirement	V	-	4 000

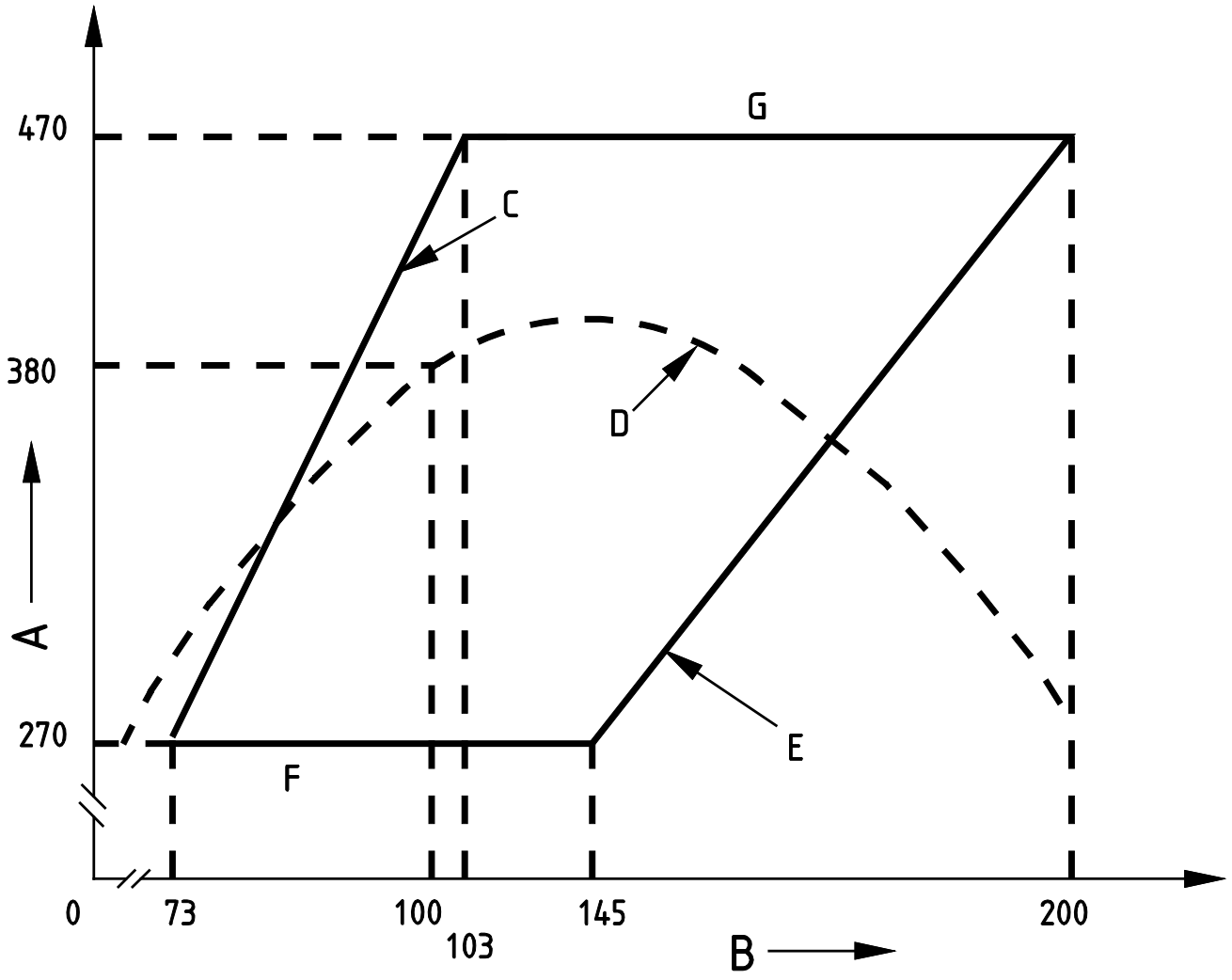
Lamp operating limits are shown graphically on page 3.

[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	12
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 3

ILCOS: STM-400-H/E-E39-59/248



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 1

ILCOS: SEM-400-H/E-E40-122/292

Nominal wattage W	Circuit	Cap	Bulb
400	With external ignitor	E40	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	122	292	-

Starting and warm-up characteristics [1)]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (applied with the device in Clause 8; see also Annex A)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	µs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

[1)] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 2

ILCOS: SEM-400-H/E-E40-122/292

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	385	-	-
Voltage (r.m.s.) at lamp terminals	V	105	90	120
Current (r.m.s.)	A	4,4	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	125	-	-

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 170
Chromaticity co-ordinates x/y (nominal)		0,510/0,420
Colour rendering index R_a (nominal)		≥60

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	400	220	4,6	39,0	0,06 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	4,6	7,5
Pulse height (peak), luminaire requirement	V	-	5 000

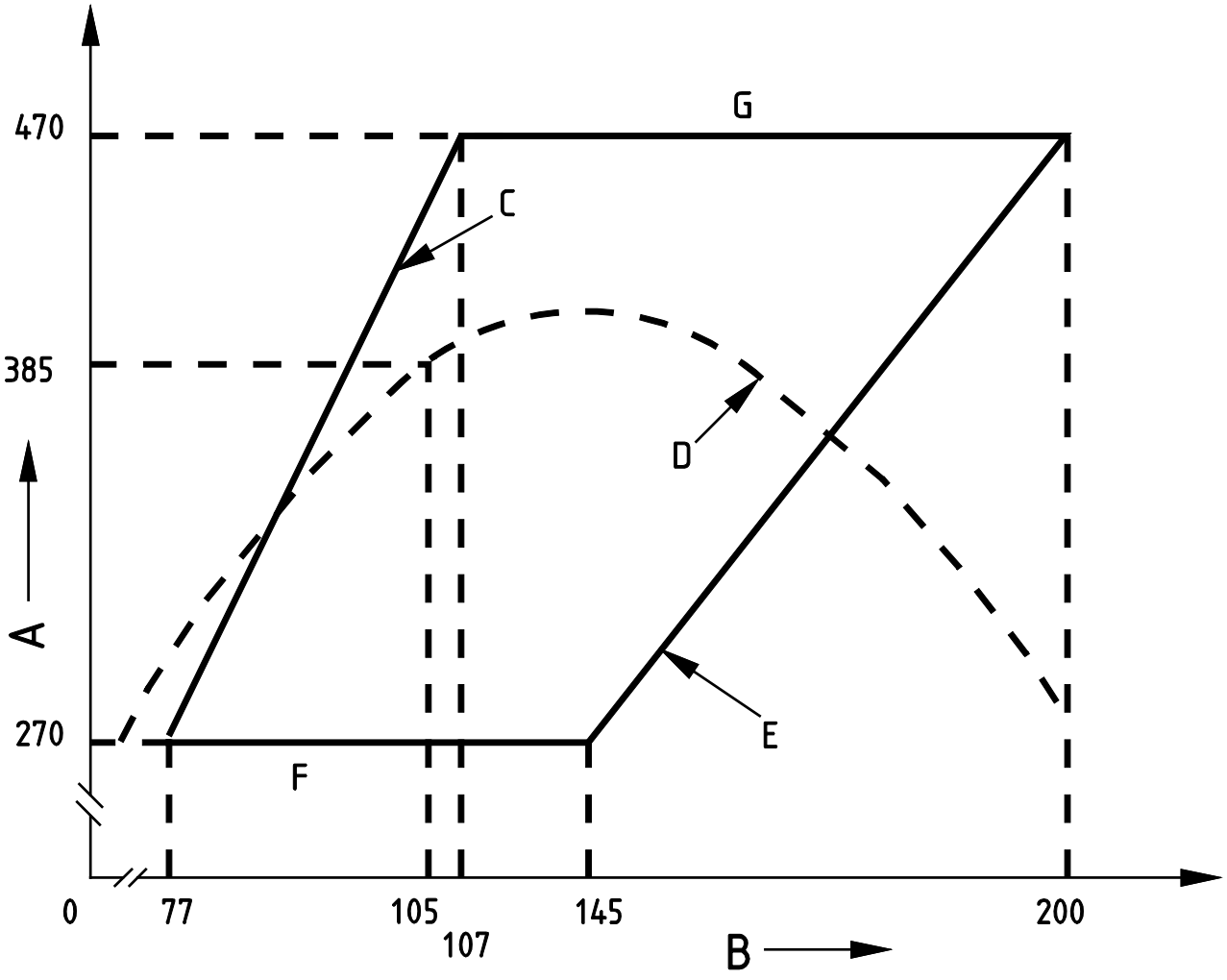
Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	7
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 3

ILCOS: SEM-400-H/E-E40-122/292



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key
A Lamp wattage (W)
B Lamp voltage (V)
C Minimum lamp voltage (V)
D Ballast characteristic curve
E Maximum lamp voltage (V)
F Minimum lamp wattage (W)
G Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 1

ILCOS: SEM-400-H/E-E39-122/292

Nominal wattage W	Circuit	Cap	Bulb
400	With external ignitor	E39	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	122	292	-

Starting and warm-up characteristics			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)			
Height (peak) A	V	-2 200	-2 250
Rise time T_1	µs	-	0,100
Duration time T_2 at 90 % of A	µs	0,90	1,00
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	7

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 2

ILCOS: SEM-400-H/E-E39-122/292

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	385	-	-
Voltage (r.m.s.) at lamp terminals	V	105	90	120
Current (r.m.s.)	A	4,4	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	125	-	-

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 170
Chromaticity co-ordinates x/y (nominal)		0,510/0,420
Colour rendering index R_a (nominal)		≥60

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	400	220	4,6	38,6	0,075 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	4,6	7,5
Pulse height (peak), luminaire requirement	V	-	4 000

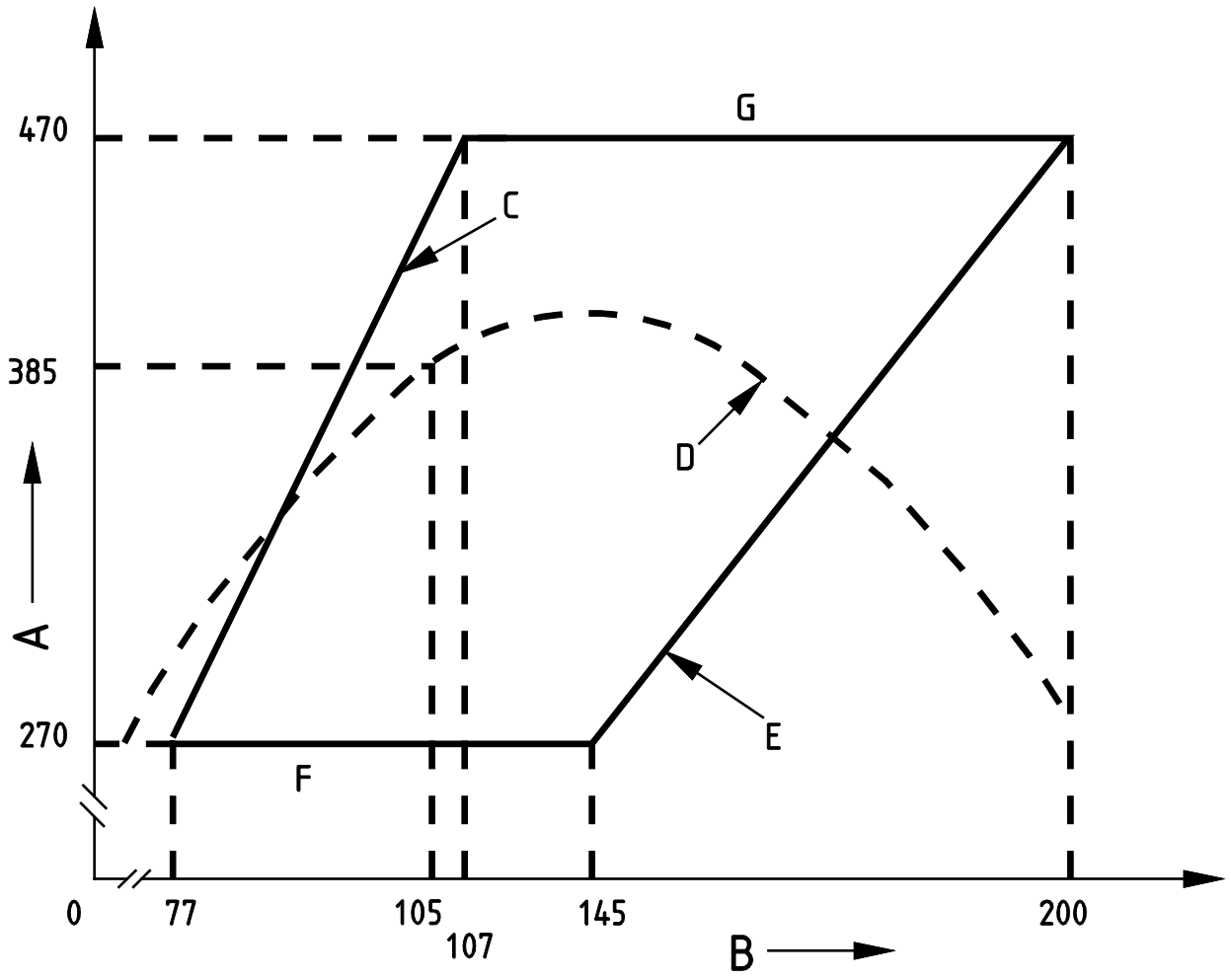
Lamp operating limits are shown graphically on page 3.

[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	7
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS COLOUR IMPROVED DATA SHEET	Page 3

ILCOS: SEM-400-H/E-E39-122/292



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **(with high colour rendering)** **DATA SHEET**	Page 1

ILCOS: SEH-400-H/I-E39-122/290

Nominal wattage W	Circuit	Cap	Bulb
400	With internal ignitor	E39	Elliptical - clear or diffuse coating

Dimensions (see Annex B)					
A* mm	C* mm		D mm	L mm	Deviation [1)] °
Nominal	Min.	Max.	Max.	Max.	Max.
49	180	190	122	290	3

* For clear bulb types

Starting and warm-up characteristics			
		Rated	Maximum
Starting for internal ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	60*

*From switch on

Warm-up			
Test voltage	V		220
Time required to reach 50 V minimum at lamp terminals	min	-	10

[1)] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference), applicable to clear lamps

	HIGH PRESSURE SODIUM VAPOUR LAMPS (with high colour rendering) DATA SHEET	Page 2

ILCOS: SEH-400-H/I-E39-122/290

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	400	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	110
Current (r.m.s.)	A	4,9	4,35	5,62
Extinguishing voltage r.m.s. (see 8.6)	V	130*	-	-

* under consideration

Photometric characteristics		
Correlated colour temperature (nominal)	K	2 500
Chromaticity co-ordinates x/y (nominal)		0,478/0,415
Colour rendering index R_a (nominal)		85

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50 or 60	400	220	4,9	34,5	0,075 ± 0,005

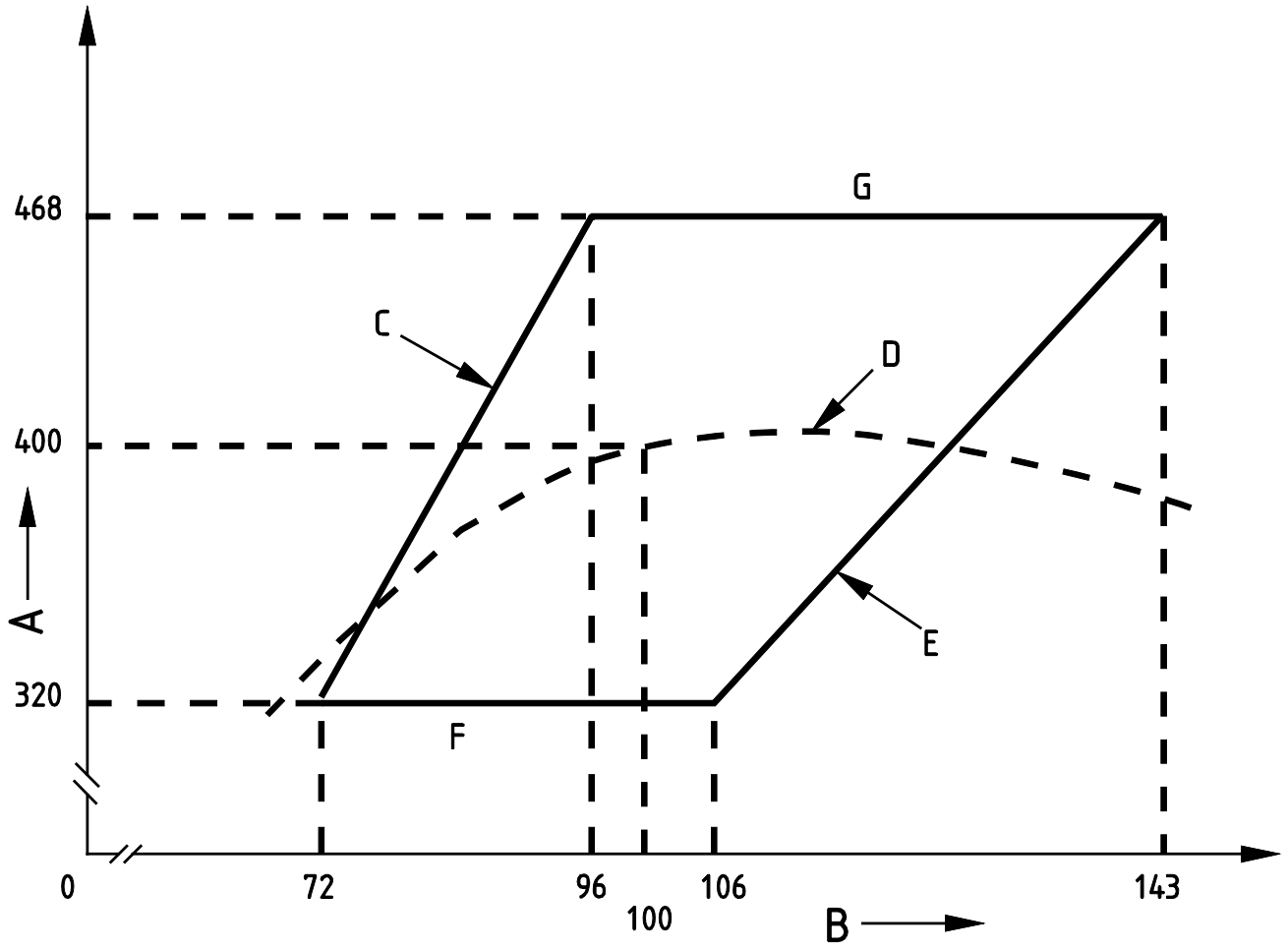
Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	4,9	7,5
Pulse height (peak), luminaire requirement	V	-	4 500

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS (with high colour rendering) DATA SHEET	Page 3

ILCOS: SEH-400-H/I-E39-122/290



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 1

ILCOS: ST-400-H/S-E40-48/292

Nominal wattage W	Circuit	Cap	Bulb
400	With external ignitor	E40	Tubular - clear

Dimensions (see Annex B)					
A* mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
85	170	180	48	292	3

* There are presently designs with a nominal arc length of 110 mm.

Starting and warm-up characteristics [2]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	4

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

[2] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 2

ILCOS: ST-400-H/S-E40-48/292

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	400	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	4,5	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	125	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	400	220	4,6	39,0	0,06 ± 0,005

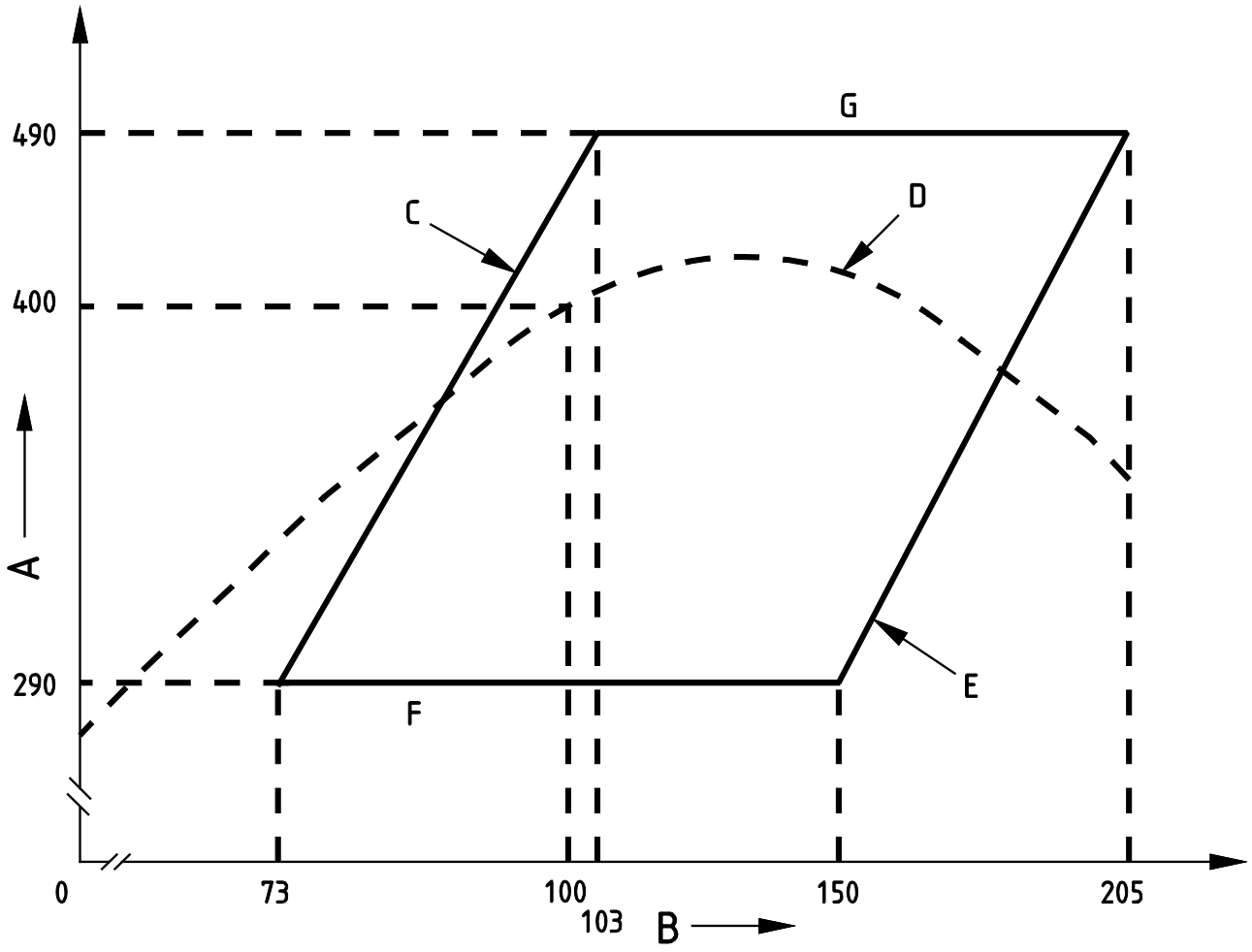
Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	4,5	7,5
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	12
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 3

ILCOS: ST-400-H/S-E40-48/292



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 1

ILCOS: SE-400-H/S-E40-122/292

Nominal wattage W	Circuit	Cap	Bulb
400	With external ignitor	E40	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	122	292	-

Starting and warm-up characteristics [1]			
		Rated	Maximum
Starting for external ignitors			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	4

[1] Additionally, fixed settings and requirements are given in Annex F.

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 2

ILCOS: SE-400-H/S-E40-122/292

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	410	-	-
Voltage (r.m.s.) at lamp terminals	V	105	90	120
Current (r.m.s.)	A	4,4	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	125	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	400	220	4,6	39,0	0,06 ± 0,005

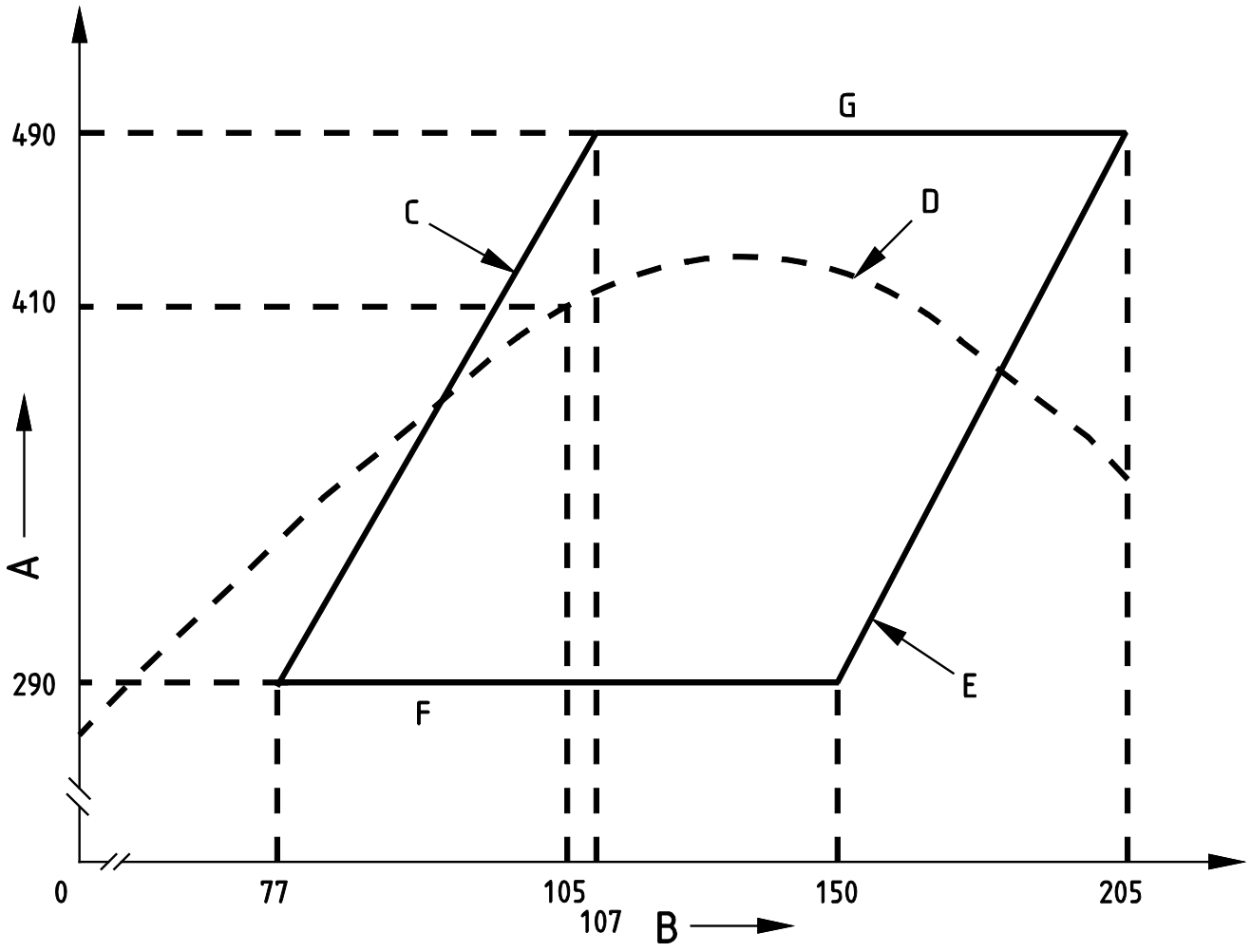
Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	4,4	7,5
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	7
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS WITH HIGH EFFICACY DATA SHEET	Page 3

ILCOS: SE-400-H/S-E40-122/292



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: ST-600-H/S-E40-48/292

Nominal wattage W	Circuit	Cap	Bulb
600	With external ignitor	E40	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
110	160	180	48	292	3

Starting and warm-up characteristics			
		Rated	Maximum
Starting for external ignitors[2]			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 600
Duration time T_2 at 90 % of A	μs	-	2,00
Repetition rate		1/half cycle	
Position (phase angle)		90	
Warm-up			
Test voltage	V	-	198
Time required to reach 50 V minimum at lamp terminals	min	-	5

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)
[2] Measurements for a 600 W lamp can be done with a 400 W ballast.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-600-H/S-E40-48/292

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	605	-	-
Voltage (r.m.s.) at lamp terminals	V	110	95	125
Current (r.m.s.)	A	6,1	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	145	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	600	220	6,1	27,8	0,06 ± 0,005

Information for ballast and ignitor design [1)]			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	6,1	9,0
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8 and Annex F.

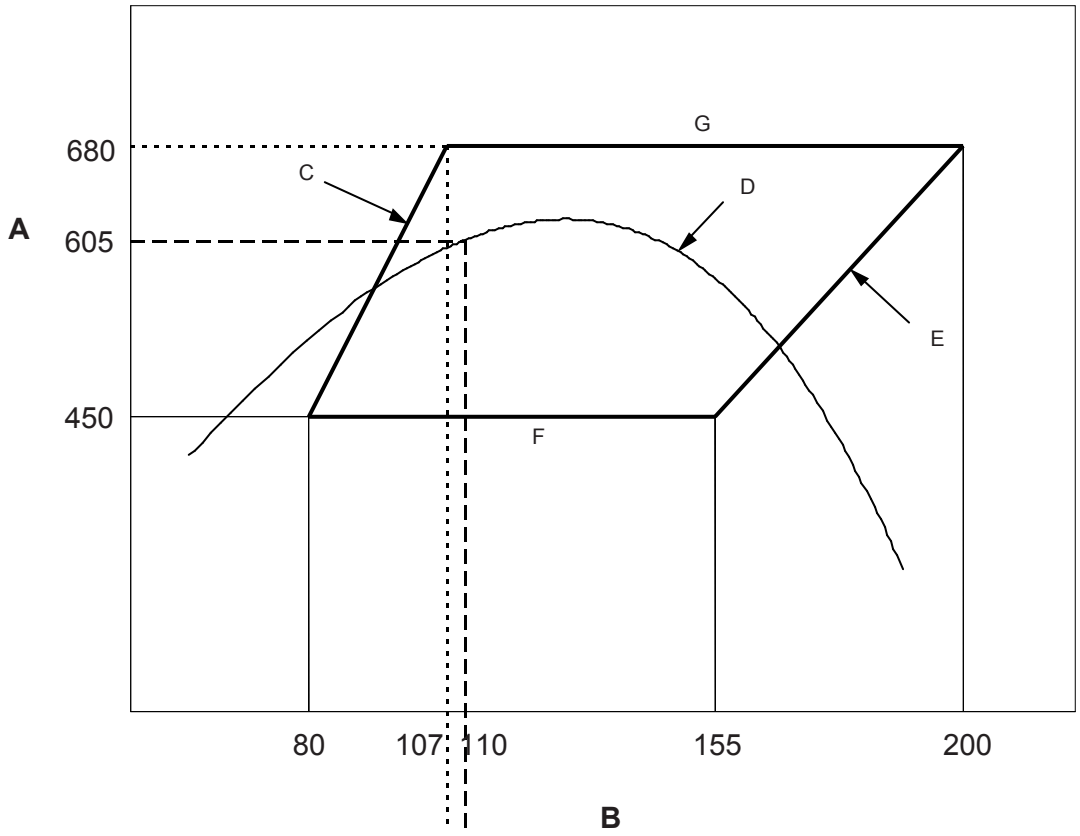
[1)] The ballast shall be matched to the actual supply voltage within 2,5 % of this voltage in order to obtain optimum performance regarding colour characteristics and life.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	12
Maximum lamp envelope temperature	°C	480 [1)]
Operating position limitation		As indicated by the lamp manufacturer

[1)] under consideration

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-600-H/S-E40-48/292



A typical ballast characteristic curve at rated supply voltage is shown by line D in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: ST-1000-H/E-E39-82/383

Nominal wattage W	Circuit	Cap	Bulb
1 000	External ignitor	E39	Tubular - clear

Dimensions (see Annex B)						
A mm		C mm		D mm	L mm	Deviation [1] °
Min.	Max.	Min.	Max.	Max.	Max.	Max.
199	255	216	228	82	383	3

Starting and warm-up characteristics				
		Rated	Minimum	Maximum
Starting for external ignitors				
Test voltage (r.m.s.)	V	-	-	456
Starting time	s	-	-	5
Pulse characteristics (see also Subclause 9.3 and Annex A, A.2)				
Height (peak) A	V	-	-2 650	-2 700
Rise time T_1	µs	-	-	0,100
Width T_2 at 50 % of A	µs	-	3,90	4,00
Warm-up				
Test voltage	V	-	-	456
Time after starting required to reach 125 V minimum at lamp terminals	min	-	-	7

[1] Deviation of any point along the centre line of the arc tube from the axis of the cap (apex of the cap eyelet used as the point of reference).

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-1000-H/E-E39-82/383

Electrical characteristics						
		Rated	Minimum		Maximum	
Wattage	W	1 000	-		-	
Voltage (r.m.s.) at lamp terminals	V	250	194 [1)]	210 [2)]	278 [1)]	275 [2)]
Current (r.m.s.)	A	4,7	-		-	
Extinguishing voltage r.m.s. (see 8.6)	V	278	-		-	

[1)] at input voltage; [2)] at set input wattage
Only one method of how to obtain the lamp voltage shall be used and stated as such.

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
60	1 000	480	4,7	77	0,075 ± 0,005

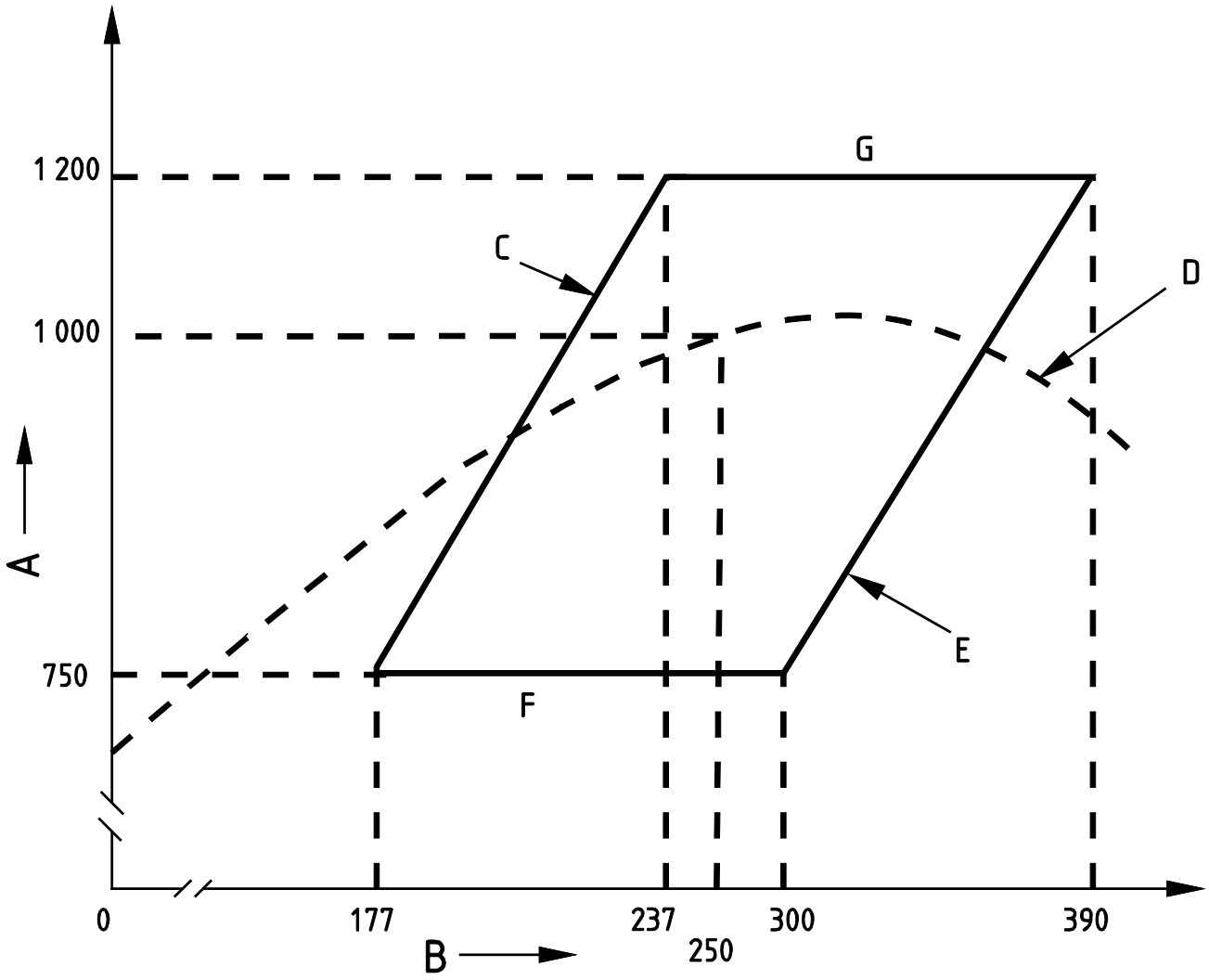
Information for ballast and ignitor design			
		Minimum	Maximum
Open circuit voltage (r.m.s.), lag circuit	V	456	-
Open circuit voltage (r.m.s.), lead circuit	V	456	-
Pulse height (peak)	V	-3 000	-
Pulse width	μs	4 at 2 700 V	
Lamp warm-up current (r.m.s.)	A	4,7	8,0
Pulse height (peak), luminaire requirement	V	-	-5 000
Current off time at maximum short-circuit current	ms		2,5
Current off time at nominal lamp operating current	ms		2,0

Lamp operating limits are shown graphically on page 3.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	25
Operating position limitation		As indicated by the lamp manufacturer
Lampholder pulse voltage rating (peak)	V	5 000

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-1000-H/E-E39-82/383



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 1

ILCOS: ST-1000-H/E-E40-68/400

Nominal wattage W	Circuit	Cap	Bulb
1 000	With external ignitor	E40	Tubular - clear

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation [1] °
Nominal	Min.	Max.	Max.	Max.	Max.
155	232	248	68	400	3

Starting and warm-up characteristics			
		Rated	Maximum
Starting for external ignitors [2]			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics (applied with the device in Clause 8; see also Annex A, A.1)			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	5

[1] Deviation of any point along the centre line of the arc tube from the axis for the cap (apex of the cap eyelet used as the point of reference)

[2] Measurements for a 1 000 W lamp can be done with a 400 W ballast.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: ST-1000-H/E-E40-68/400

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	960	-	-
Voltage (r.m.s.) at lamp terminals	V	100	85	115
Current (r.m.s.)	A	10,6	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	128	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	1 000	220	10,3	16,8	0,06 ± 0,005
60	1 000	220	10,3	16,8	0,06 ± 0,005

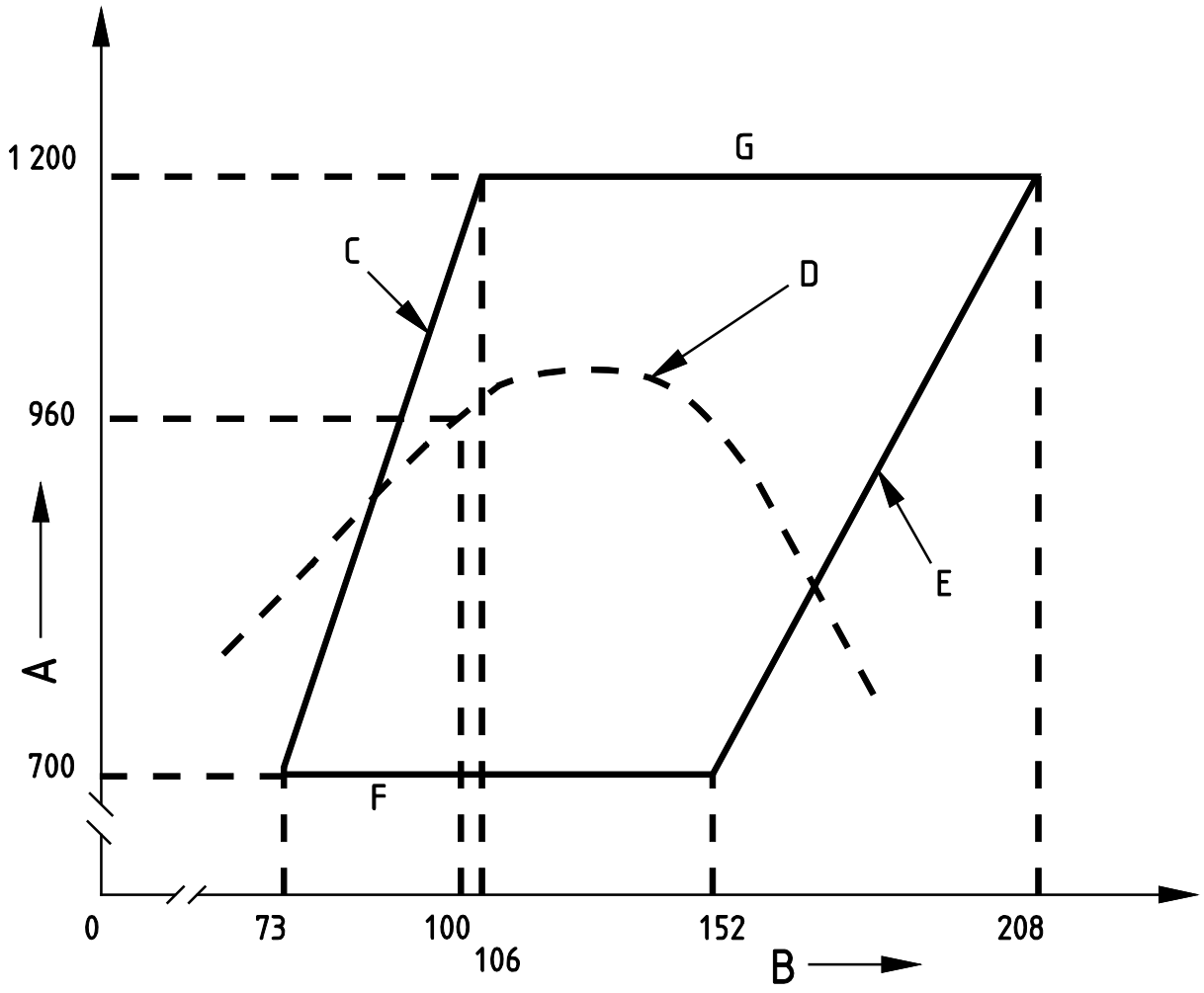
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	10,3	15,0
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	20
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: ST-1000-H/E-E40-68/400



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

	HIGH PRESSURE SODIUM VAPOUR LAMPS **DATA SHEET**	Page 1

ILCOS: SE-1000-H/E-E40-170/410

Nominal wattage W	Circuit	Cap	Bulb
1 000	With external ignitor	E40	Elliptical - diffuse coating

Dimensions (see Annex B)					
A mm	C mm		D mm	L mm	Deviation °
Nominal	Min.	Max.	Max.	Max.	Max.
-	-	-	170	410	-

Starting and warm-up characteristics			
		Rated	Maximum
Starting for external ignitors [1)]			
Test voltage (r.m.s.)	V	-	198
Starting time	s	-	10
Pulse characteristics			
Height (peak) A	V	-	3 300
Duration time T_2 at 90 % of A	μs	-	2
Repetition rate		1/full cycle	
Position (phase angle) of the open circuit voltage	°	90	
Warm-up			
Test voltage	V		198
Time required to reach 50 V minimum at lamp terminals	min	-	5

[1)] Measurements for a 1 000 W lamp can be done with a 400 W ballast.

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 2

ILCOS: SE-1000-H/E-E40-170/410

Electrical characteristics				
		Rated	Minimum	Maximum
Wattage	W	1 000	-	-
Voltage (r.m.s.) at lamp terminals	V	110	95	125
Current (r.m.s.)	A	10,3	-	-
Extinguishing voltage r.m.s. (see 8.6)	V	128	-	-

Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A		
50	1 000	220	10,3	16,8	0,06 ± 0,005
60	1 000	220	10,3	16,8	0,06 ± 0,005

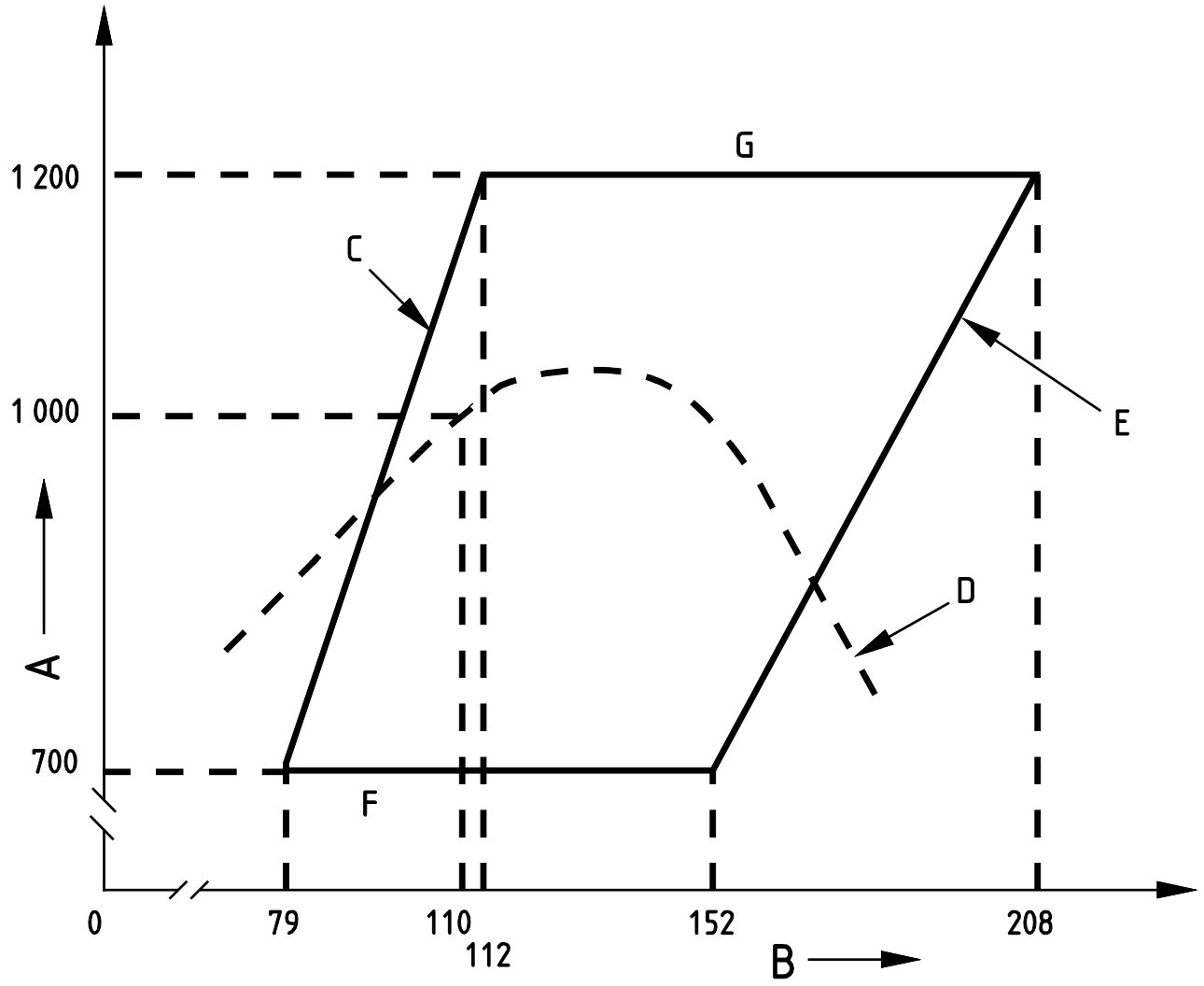
Information for ballast and ignitor design			
		Minimum	Maximum
Lamp warm-up current (r.m.s.)	A	10,3	15,0
Pulse height (peak), luminaire requirement	V	-	5 000

Lamp operating limits are shown graphically on page 3.
For ignition, see also Clause 8.

Information for luminaire design		
Maximum voltage increase at lamp terminals	V	10
Operating position limitation		As indicated by the lamp manufacturer

	HIGH PRESSURE SODIUM VAPOUR LAMPS DATA SHEET	Page 3

ILCOS: SE-1000-H/E-E40-170/410



A typical ballast characteristic curve at rated supply voltage is shown by the dotted line in the diagram.

Key

A	Lamp wattage (W)
B	Lamp voltage (V)
C	Minimum lamp voltage (V)
D	Ballast characteristic curve
E	Maximum lamp voltage (V)
F	Minimum lamp wattage (W)
G	Maximum lamp wattage (W)

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