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Acts whose titles are printed in light type are those relating to day-to-day management of agricultural matters, and are generally valid for a limited period.

The titles of all other acts are printed in bold type and preceded by an asterisk.

II

*(Non-legislative acts)***ACTS ADOPTED BY BODIES CREATED BY
INTERNATIONAL AGREEMENTS**

Only the original UN/ECE texts have legal effect under international public law. The status and date of entry into force of this Regulation should be checked in the latest version of the UN/ECE status document TRANS/WP.29/343, available at:
<http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29fdocsts.html>

**Regulation No 37 of the Economic Commission for Europe of the United Nations (UN/ECE) —
Uniform provisions concerning the approval of filament lamps for use in approved lamp units on
power-driven vehicles and of their trailers**

Incorporating all valid text up to:

Supplement 34 to the 03 series of amendments — Date of entry into force: 19 August 2010.

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1. SCOPE

This Regulation applies to filament lamps shown in Annex 1 and intended for use in approved lamp units of power-driven vehicles and of their trailers.

2. ADMINISTRATIVE PROVISIONS

2.1. Definitions

2.1.1. Definition of 'category'

The term 'category' is used in this Regulation to describe different basic design of standardised filament lamps. Each category has a specific designation, as for example: 'H4', 'P21W', 'T4W', 'PY21W' or 'RR10W'.

2.1.2. Definition of 'type'

Filament lamps of different 'types' ⁽¹⁾ are filament lamps within the same category which differ in such essential respects as:

- 2.1.2.1. trade name or mark (Filament lamps bearing the same trade name or mark but produced by different manufacturers are considered as being of different types. Filament lamps produced by the same manufacturer differing only by the trade name or mark may be considered to be of the same type);

⁽¹⁾ A selective-yellow bulb or an additional selective-yellow outer bulb, solely intended to change the colour but not the other characteristics of a filament lamp emitting white light, does not constitute a change of type of the filament lamp.

2.1.2.2. bulb design and/or cap design, in so far as these differences affect the optical results;

2.1.2.3. rated voltage;

2.1.2.4. halogen.

2.2. **Application for approval**

2.2.1. Application for approval shall be submitted by the owner of the trade name or mark, or by his duly accredited representative.

2.2.2. Every application for approval shall be accompanied (see also paragraph 2.4.2) by:

2.2.2.1. drawings in triplicate, sufficiently detailed to permit identification of the type;

2.2.2.2. a brief technical description;

2.2.2.3. five samples of each colour which has been applied for.

2.2.3. In the case of a type of filament lamp differing only by the trade name or mark from a type that has already been approved it shall be sufficient to submit:

2.2.3.1. a declaration by the manufacturer that the type submitted is identical (except in the trade name or mark) with and has been produced by the same manufacturer as, the type already approved, the latter being identified by its approval code;

2.2.3.2. two samples bearing the new trade name or mark.

2.2.4. The competent authority shall verify the existence of satisfactory arrangements for ensuring effective control of the conformity of production before type approval is granted.

2.3. **Inscriptions**

2.3.1. Filament lamps submitted for approval shall bear on the cap or bulb ⁽²⁾:

2.3.1.1. the trade name or mark of the applicant;

2.3.1.2. the rated voltage. However, for filament lamps for which only a 12 V type is standardised and the maximum allowed bulb diameter of which does not exceed 7,5 mm, the rated voltage need not be marked;

2.3.1.3. the international designation of the relevant category. The wattage character 'W' of this designation need not be marked when the maximum allowed bulb diameter of the filament lamp type does not exceed 7,5 mm;

2.3.1.4. the rated wattage (in the sequence, high wattage/low wattage filament for dual-filament lamps); this need not be indicated separately if it is part of the international designation of the relevant filament lamp category;

2.3.1.5. a space of sufficient size to accommodate the approval mark.

⁽²⁾ In the latter case, the luminous characteristics shall not be adversely affected.

- 2.3.2. The space mentioned in paragraph 2.3.1.5 above shall be indicated in the drawings accompanying the application for approval.
- 2.3.3. Halogen filament lamps meeting the requirements of paragraph 3.7 below shall be marked with a 'U'.
- 2.3.4. Inscriptions other than those covered by paragraphs 2.3.1 and 2.4.3 may be affixed, on the condition that they do not adversely affect the luminous characteristics.

2.4. Approval

- 2.4.1. If all samples of a type of filament lamp which are submitted in pursuance of paragraphs 2.2.2.3 or 2.2.3.2 above meet the requirements of this Regulation, approval shall be granted.
- 2.4.2. An approval code shall be assigned to each type approved. Its first character (at present 2, corresponding to the 02 series of amendments which entered into force on 27 October 1983 and to the 03 series of amendments (not requiring changes in the approval number), which entered into force on 1 June 1984) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. This will be followed by an identification code comprising not more than two characters. Only the Arabic numerals and capital letters listed in footnote 3 ⁽³⁾ shall be used. The same Contracting Party may not assign the same code to another type of filament lamp. Notice of approval or of extension or refusal or withdrawal of approval or production definitely discontinued of a type of filament lamp pursuant to this Regulation shall be communicated to the Parties of the Agreement which apply this Regulation by means of a form conforming to the model in Annex 2 to this Regulation and of a drawing, supplied by the applicant for approval in a format not exceeding A4 (210 x 297 mm) and on a scale of at least 2:1. If the applicant so desires, the same approval code may be assigned to the filament lamp emitting white light and to the filament lamp emitting selective-yellow light (see paragraph 2.1.2.3).
- 2.4.3. To every filament lamp conforming to a type approved under this Regulation there shall be affixed in the space referred to in paragraph 2.3.1.5, in addition to the inscriptions required under paragraph 2.3.1, an international approval mark consisting of:
- 2.4.3.1. a truncated circle surrounding the letter 'E' followed by the distinguishing number of the country which has granted approval ⁽⁴⁾;
- 2.4.3.2. the approval code, placed close to the truncated circle.
- 2.4.4. If the applicant has obtained the same approval code for several trade names or marks, one or more of them will suffice to meet the requirements of paragraph 2.3.1.1.

⁽³⁾ 0 1 2 3 4 5 6 7 8 9

A B C D E F G H J K L M N P R S T U V W X Y Z.

⁽⁴⁾ 1 for Germany, 2 for France, 3 for Italy, 4 for the Netherlands, 5 for Sweden, 6 for Belgium, 7 for Hungary, 8 for the Czech Republic, 9 for Spain, 10 for Serbia, 11 for the United Kingdom, 12 for Austria, 13 for Luxembourg, 14 for Switzerland, 15 (vacant), 16 for Norway, 17 for Finland, 18 for Denmark, 19 for Romania, 20 for Poland, 21 for Portugal, 22 for the Russian Federation, 23 for Greece, 24 for Ireland, 25 for Croatia, 26 for Slovenia, 27 for Slovakia, 28 for Belarus, 29 for Estonia, 30 (vacant), 31 for Bosnia and Herzegovina, 32 for Latvia, 33 (vacant), 34 for Bulgaria, 35 (vacant), 36 for Lithuania, 37 for Turkey, 38 (vacant), 39 for Azerbaijan, 40 for The former Yugoslav Republic of Macedonia, 41 (vacant), 42 for the European Community (Approvals are granted by its Member States using their respective ECE symbol), 43 for Japan, 44 (vacant), 45 for Australia, 46 for Ukraine, 47 for South Africa, 48 for New Zealand, 49 for Cyprus, 50 for Malta, 51 for the Republic of Korea, 52 for Malaysia, 53 for Thailand, 54 and 55 (vacant), 56 for Montenegro, 57 (vacant) and 58 for Tunisia. Subsequent numbers shall be assigned to other countries in the chronological order in which they ratify or accede to the Agreement concerning the adoption of uniform technical prescriptions for wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles and the conditions for reciprocal recognition of approvals granted on the basis of these prescriptions, and the numbers thus assigned shall be communicated by the Secretary-General of the United Nations to the Contracting Parties to the Agreement.

2.4.5. The marks and inscriptions specified in paragraphs 2.3.1 and 2.4.3 shall be clearly legible and be indelible.

2.4.6. Annex 3 to this Regulation gives an example of arrangement of the approval mark.

3. TECHNICAL REQUIREMENTS

3.1. Definitions

3.1.1. 'Rated voltage': voltage (in volts) marked on the filament lamp.

3.1.2. 'Rated wattage': wattage (in watts) marked on the filament lamp which may be incorporated into the international designation of the relevant category.

3.1.3. 'Test voltage': voltage, at the filament lamp terminals for which the electrical and photometric characteristics of the filament lamp are intended and are to be tested.

3.1.4. 'Objective values': values to be achieved, within the specified tolerances, when the filament lamp is supplied with current at its test voltage.

3.1.5. 'Standard (étalon) filament lamp': a filament lamp emitting white or amber or red light with reduced dimensional tolerances, used for the photometric testing of lighting and light-signalling devices. Standard filament lamps are specified in only one voltage rating for each category.

3.1.6. 'Reference luminous flux': specified luminous flux of a standard filament lamp to which the optical characteristics of a lighting device shall be referred.

3.1.7. 'Measuring luminous flux': specified value of the luminous flux for testing a filament lamp in a standard headlamp as specified in paragraph 3.9.

3.1.8. 'Reference axis': an axis defined with reference to the cap and to which certain dimensions of the filament lamp are referred.

3.1.9. 'Reference plane': a plane defined with reference to the cap and to which certain dimensions of the filament lamp are referred.

3.2. General specifications

3.2.1. Each sample submitted shall conform to the relevant specifications of this Regulation.

3.2.2. Filament lamps shall be so designed as to be and to remain in good working order when in normal use. They shall moreover exhibit no fault in design or manufacture.

3.3. Manufacture

3.3.1. Filament lamp bulbs shall exhibit no scores or spots which might impair their efficiency and their optical performance.

3.3.2. Filament lamps shall be equipped with standard caps complying with the cap data sheets of IEC Publication 60061, third edition, as specified on the individual data sheets of Annex 1.

3.3.3. The cap shall be strong and firmly secured to the bulb.

3.3.4. To ascertain whether filament lamps conform to the requirements of paragraphs 3.3.1 to 3.3.3 above, a visual inspection, a dimension check and, where necessary, a trial fitting shall be carried out.

3.4. Tests

3.4.1. Filament lamps shall first be aged at their test voltage for approximately one hour. For dual-filament lamps, each filament shall be aged separately.

3.4.2. In the case of a filament lamp having a coated bulb, after the ageing period corresponding to paragraph 3.4.1, the surface of the bulb shall be lightly wiped with a cotton cloth soaked in a mixture of 70 vol. per cent of n-heptane and 30 vol. per cent of toluol. After about five minutes, the surface shall be inspected visually. It shall not show any apparent changes.

3.4.3. The position and dimensions of the filament shall be measured with the filament lamps being supplied with current at from 90 per cent to 100 per cent of the test voltage.

3.4.4. Unless otherwise specified, electrical and photometric measurements shall be carried out at the test voltage.

3.4.5. Electrical measurements shall be carried out with instruments of at least class 0.2.

3.4.6. The luminous flux (in lumen) specified on the filament lamp data sheets of Annex 1 is valid for filament lamps emitting white light unless a special colour is stated there.

In the case where the selective-yellow colour is allowed, the luminous flux of the filament lamp with the selective-yellow outer bulb shall be at least 85 per cent of the specified luminous flux of the relevant filament lamp emitting white light.

3.5. Filament position and dimensions

3.5.1. The geometric shapes of the filament shall in principle be as specified on the filament lamp data sheets of Annex 1.

3.5.2. For line filaments the correct position and shape shall be checked as specified in the relevant data sheets.

3.5.3. If the filament is shown on the filament lamp data sheet in at least one view as a point, the position of the luminous centre shall be determined in conformity with Annex 4.

3.5.4. The length of a line filament shall be determined by its ends, defined — unless otherwise specified on the relevant data sheet — as the apices of the first and the last filament turn as seen in projection perpendicular to the reference axis of the filament lamp. Such an apex shall comply with the requirement that the angle formed by the legs shall not exceed 90°. In the case of coiled-coil filaments the apices of the secondary turns shall be taken into account.

3.5.4.1. For axial filaments the extreme position of the apices considered shall be determined by rotating the filament lamp about its reference axis. The length shall then be measured in a direction parallel to the reference axis.

3.5.4.2. For transverse filaments the filament axis shall be placed perpendicular to the direction of projection. The length shall be measured in a direction perpendicular to the reference axis.

3.6. Colour

3.6.1. The colour of the light emitted by the filament lamp shall be white unless otherwise specified on the relevant data sheet.

3.6.2. The definitions of the colour of the light emitted, given in Regulation No 48 and its series of amendments in force at the time of application for type approval, shall apply to this Regulation.

3.6.3. The colour of the light emitted shall be measured by the method specified in Annex 5. Each measured value shall lie within the required tolerance area ⁽⁵⁾. Moreover, in the case of filament lamps emitting white light, the measured values shall not deviate more than 0,020 units in the x and/or y direction from a point of choice on the Planckian locus (IEC Publication 15.2 Colorimetry, 1986). Filament lamps for use in light signalling devices shall meet the requirements as specified in paragraph 2.4.2 of IEC Publication 60809, Amendment [5] to Edition 2.

3.7. UV radiation

The UV radiation of a halogen lamp shall be such that:

$$k_1 = \frac{\int_{\lambda = 315 \text{ nm}}^{400 \text{ nm}} E_e(\lambda) \cdot d\lambda}{780 \text{ nm}} \leq 2 \cdot 10^{-4} \text{ W/lm}$$

$$k_m \cdot \int_{\lambda = 380 \text{ nm}} E_e(\lambda) \cdot V(\lambda) \cdot d\lambda$$

$$k_2 = \frac{\int_{\lambda = 250 \text{ nm}}^{315 \text{ nm}} E_e(\lambda) \cdot d\lambda}{780 \text{ nm}} \leq 2 \cdot 10^{-6} \text{ W/lm}$$

$$k_m \cdot \int_{\lambda = 380 \text{ nm}} E_e(\lambda) \cdot V(\lambda) \cdot d\lambda$$

where:

$E_e(\lambda)$	(W/nm)	is the spectral distribution of the radiant flux;
$V(\lambda)$	(1)	is the spectral luminous efficiency;
$k_m = 683$	(lm/W)	is the photometric radiation equivalent;
λ	(nm)	is the wave length.

This value shall be calculated using intervals of five nanometres.

⁽⁵⁾ For Conformity of Production purposes of amber and red colour only, at least 80 per cent of the measuring results shall lie within the required tolerance area.

3.8. Observation concerning selective-yellow colour

An approval of a filament lamp type under this Regulation may be granted, pursuant to paragraph 3.6 above, for a filament lamp emitting white light as well as selective-yellow light; Article 3 of the Agreement to which this Regulation is annexed shall not prevent the Contracting Parties from prohibiting, on vehicles registered by them, filament lamps emitting either white or selective-yellow light.

3.9. Check on optical quality

(Applies only to filament lamps of categories R2, H4 and HS1)

3.9.1. This check on optical quality shall be carried out at a voltage such that the measuring luminous flux is obtained; the specifications of paragraph 3.4.6 are to be observed accordingly.

3.9.2. For 12-Volt filament lamps emitting white light:

The sample which most nearly conforms to the requirements laid down for the standard filament lamp shall be tested in a standard headlamp as specified in paragraph 3.9.5 and it shall be verified whether the assembly comprising the aforesaid headlamp and the filament lamp being tested meets the light-distribution requirements laid down for the passing-beam in the relevant Regulation.

3.9.3. For 6-Volt and 24-Volt filament lamps emitting white light:

The sample which most nearly conforms to the nominal dimension values shall be tested in a standard headlamp as specified in paragraph 3.9.5 and it shall be verified whether the assembly comprising the aforesaid headlamp and the filament lamp being tested meets the light-distribution requirements laid down for the passing-beam in the relevant Regulation. Deviations not exceeding 10 per cent of the minimum values will be acceptable.

3.9.4. Filament lamps emitting selective-yellow light shall be tested in the same manner as described in paragraphs 3.9.2 and 3.9.3 in a standard headlamp as specified in paragraph 3.9.5 to ensure that the illumination complies with at least 85 per cent for 12-Volt filament lamps, and at least 77 per cent for 6-Volt and 24-Volt filament lamps, with the minimum values of the light-distribution requirements laid down for the passing-beam in the relevant Regulation. The maximum illumination limits remain unchanged.

In the case of a filament lamp having a selective-yellow bulb, this test shall be left out if the approval is also given to the same type of filament lamp emitting white light.

3.9.5. A headlamp shall be deemed to be a standard headlamp if:

3.9.5.1. it satisfies the pertinent conditions of approval;

3.9.5.2. it has an effective diameter of not less than 160 mm;

3.9.5.3. with a standard filament lamp it produces at the various points and in the various zones specified for the headlamp type concerned, illumination equal to:

3.9.5.3.1. not more than 90 per cent of the maximum limits;

3.9.5.3.2. not less than 120 per cent of the minimum limits prescribed for the headlamp type concerned.

3.10. **Standard filament lamps**

Additional requirements for standard (étalon) filament lamps are given on the relevant data sheets of Annex 1.

Bulbs of standard (étalon) filament lamps emitting white light shall not alter the CIE trichromatic coordinates of a luminous source having a colour temperature of 2 856 K by more than 0,010 units in the x and/or y direction.

For standard (étalon) filament lamps emitting amber or red light, changes of the bulb temperature shall not affect the luminous flux which might impair photometric measurements of signalling devices.

4. CONFORMITY OF PRODUCTION

4.1. Filament lamps approved to this Regulation shall be so manufactured as to conform to the type approved by meeting the inscriptions and technical requirements set forth in paragraph 3 above and Annexes 1, 3 and 4 to this Regulation.

4.2. In order to verify that the requirements of paragraph 4.1 are met, suitable controls of the production shall be carried out.

4.3. The holder of the approval shall in particular:

4.3.1. ensure existence of procedures for the effective control of the quality of products;

4.3.2. have access to the control equipment necessary for checking the conformity to each approved type;

4.3.3. ensure that data of test results are recorded and that related documents shall remain available for a period to be determined in accordance with the administrative service;

4.3.4. analyse the results of each type of test, applying criteria of Annex 7, in order to verify and ensure the stability of the product characteristics making allowance for variation of an industrial production;

4.3.5. ensure that for each type of filament lamp, at least the tests prescribed in Annex 6 to this Regulation are carried out;

4.3.6. ensure that any collecting of samples giving evidence of non-conformity with the type of test considered shall give rise to another sampling and another test. All the necessary steps shall be taken to re-establish the conformity of the corresponding production.

4.4. The competent authority which has granted type-approval may at any time verify the conformity control methods applicable to each production unit.

4.4.1. In every inspection, the test books and production survey records shall be presented to the visiting inspector.

4.4.2. The inspector may take samples at random which will be tested in the manufacturer's laboratory. The minimum number of samples may be determined according to the results of the manufacturer's own verification.

- 4.4.3. When the quality level appears unsatisfactory or when it seems necessary to verify the validity of the tests carried out in application of paragraph 4.4.2 above, the inspector shall select samples, to be sent to the technical service which has conducted the type approval tests.
- 4.4.4. The competent authority may carry out any tests prescribed in this Regulation. Where the competent authority decides to carry out spot checks, criteria of Annexes 8 and 9 to this Regulation shall be applied.
- 4.4.5. The normal frequency of inspection authorised by the competent authority shall be one every two years. In the case where negative results are recorded during one of these visits, the competent authority shall ensure that all necessary steps are taken to re-establish the conformity of production as rapidly as possible.
5. PENALTIES FOR NON-CONFORMITY OF PRODUCTION
- 5.1. The approval granted in respect of a filament lamp pursuant to this Regulation may be withdrawn if the requirements are not met or if a filament lamp bearing the approval mark does not conform to the type approved.
- 5.2. If a Contracting Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a communication form conforming to the model in Annex 2 to this Regulation.
6. PRODUCTION DEFINITELY DISCONTINUED
- If the holder of the approval completely ceases to manufacture a type of filament lamp approved in accordance with this Regulation, he shall so inform the authority which has granted the approval. Upon receiving the relevant communication, that authority shall inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 2 to this Regulation.
7. NAMES AND ADDRESSES OF THE TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS, AND OF ADMINISTRATIVE DEPARTMENTS
- The Parties to the 1958 Agreement which apply this Regulation shall communicate to the United Nations secretariat the names and addresses of the technical services responsible for conducting approval tests and of the administrative departments which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, or production definitely discontinued issued in other countries, are to be sent.
8. TRANSITIONAL PROVISIONS
- 8.1. Approvals granted under the preceding series of amendments shall remain valid, except that for conformity of production, current production filament lamps shall comply with the requirements of the latest series of amendments starting 12 months from the date of application of this amendment ⁽⁶⁾.

⁽⁶⁾ The amended text of this paragraph was introduced by Supplement 14 to the 03 series of amendments. This supplement entered into force on 3 September 1997 and it also introduced in the text of the Regulation new paragraphs 2.3.3 and 3.7 and in Annex 1 new sheets HIR1 and PY27/7W.

- 8.2. The correspondence between the former designations and the new ones is indicated in the following table:

Old designations	New designations in the 03 series of amendments
P25-1	P21W
P25-2	P21/5W
R19/5	R5W
R19/10	R10W
C11	C5W
C15	C21W
T8/4	T4W
W10/5	W5W
W10/3	W3W

- 8.3. As from 12 months after the entry into force of the Supplement 28 to the 03 series of amendments to Regulation No 37, no filament lamps of the categories R2, S1 and C21W shall be used in lamps for type approval purposes.
- 8.4. However, Contracting Parties applying this Regulation may continue to grant approvals for lamps where filament lamps of categories R2, S1 and C21W are used, provided that these lamps are intended as replacement parts for installation on vehicles in use.
-

ANNEX 1

SHEETS (*) FOR FILAMENT LAMPS

List of categories of filament lamps, grouped and their sheet numbers:

Group 1

Without general restrictions:

Category	Sheet number(s)	Category	Sheet number(s)
H1	H1/1 to 3	H27W/1	H27W/1 to 3
H3	H3/1 to 4	H27W/2	H27W/1 to 3
H4	H4/1 to 5	HB3	HB3/1 to 4
H7	H7/1 to 4	HB3A	HB3/1 to 4
H8	H8/1 to 4	HB4	HB4/1 to 4
H8B	H8/1 to 4	HB4A	HB4/1 to 4
H9 (**)	H9/1 to 4	HIR1 (***)	HIR1/1 to 3
H9B (***)	H9/1 to 4	HIR2	HIR2/1 to 3
H10	H10/1 to 3	HS1	HS1/1 to 5
H11	H11/1 to 4	HS2	HS2/1 to 3
H11B	H11/1 to 4	HS5	HS5/1 to 4
H12	H12/1 to 3	HS5A (****)	HS5A/1 to 3
H13	H13/1 to 4	HS6 (****)	HS6/1 to 4
H13A	H13/1 to 4	PSX24W (**)	P24W/1 to 3
H14	H14/1 to 4	PSX26W (**)	PSX26W1 to 3
H15	H15/1 to 5	PX24W (**)	P24W/1 to 3
H16	H16/1 to 4	S2	S1/S2/1 to 2
H21W (**)	H21W/1 to 2	S3	S3/1

(*) Tables, electrical and photometric characteristics:

Voltage is expressed in V;

Wattage is expressed in W;

Luminous flux is expressed in lm.

In a case that for a category of filament lamp more than one value of reference luminous flux is specified, the value at approximately 12 V for approval of a lighting device and 13,5 V for approval of a light-signalling device shall be applied unless otherwise specified by the regulation used for the approval of the device.

(**) Not for use in passing beam headlamps.

(***) Not for use in front fog lamps marked 'B' as defined in Regulation No 19.

(****) Not for use in Regulation No 112 headlamps.

(*****) Not for use in headlamps other than Regulation 113 class C headlamps.

Group 2

Only for use in signalling lamps, cornering lamps, reversing lamps and rear registration plate lamps:

Category	Sheet number(s)	Category	Sheet number(s)
C5W	C5W/1	PSY19W	P19W/1 to 3
H6W	H6W/1	PSY24W	P24W/1 to 3
H10W/1	H10W/1 to 2	PY19W	P19W/1 to 3
HY6W	H6W/1	PY21W	PY21W/1 (P21W/2)
HY10W	H10W/1 to 2	PY24W	P24W/1 to 3
HY21W	H21W/1 to 2	PY27/7W	PY27/7W/1 (P27/7W/2 to 3)
P13W	P13W/1 to 3	R5W	R5W/1
P19W	P19W/1 to 3	R10W	R10W/1
P21W	P21W/1 to 2	RR5W	R5W/1
P21/4W	P21/4W/1 (P21/5W/2 to 3)	RR10W	R10W/1
P21/5W	P21/5W/1 to 3	RY10W	R10W/1
P24W	P24W/1 to 3	T1.4W	T1.4W/1
P27W	P27W/1 to 2	T4W	T4W/1
P27/7W	P27/7W/1 to 3	W2.3W	W2.3W/1
PC16W	PC16W/1 to 3	W3W	W3W/1
PCR16W	PC16W/1 to 3	W5W	W5W/1
PCY16W	PC16W/1 to 3	W15/5W	W15/5W/1 to 3
PR19W	P19W/1 to 3	W16W	W16W/1
PR21W	PR21W/1 (P21W/2)	W21W	W21W/1 to 2
PR21/4W	PR21/4W/1 (P21/5W/2 to 3)	W21/5W	W21/5W/1 to 3
PR21/5W	PR21/5W/1 (P21/5W/2 to 3)	WP21W	WP21W/1 to 2
PR24W	P24W/1 to 3	WPY21W	WP21W/1 to 2
PR27/7W	PR27/7W/1 (P27/7W/2 to 3)	WR5W	W5W/1
PS19W	P19W/1 to 3	WR21/5W	WR21/5W/1 (W21/5W/2 to 3)
PS24W	P24W/1 to 3	WY2.3W	WY2.3W/1
PSR19W	P19W/1 to 3	WY5W	W5W/1
PSR24W	P24W/1 to 3	WY21W	WY21W/1 to 2

Group 3

For replacement purposes only (see transitional provisions of paragraphs 8.3 and 8.4):

Category	Sheet number(s)
C21W	C21W/1 to 2
R2	R2/1 to 3
S1	S1/S2/1 to 2

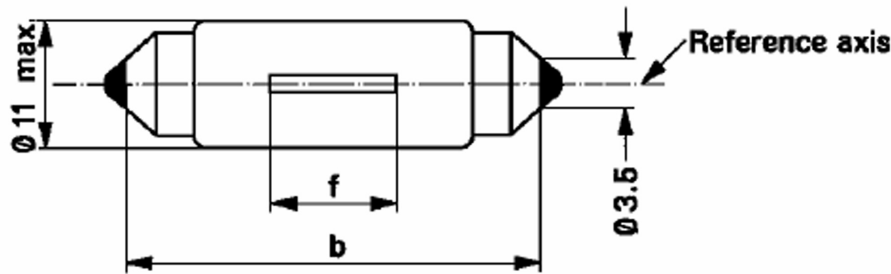
List of sheets for filament lamps and their sequence in this Annex:

Sheet number(s)

C5W/1	P21/5W/1 to 3
C21W/1 to 2	P24W/1 to 3
H1/1 to 3	P27W/1 to 2
H3/1 to 4	P27/7W/1 to 3
H4/1 to 5	PC16W/1 to 3
H7/1 to 4	PR21W/1
H8/1 to 4	PR21/4W/1
H9/1 to 4	PR21/5W/1
H10/1 to 3	PR27/7W/1
H11/1 to 4	PSX26W/1 to 3
H12/1 to 3	PY21W/1
H13/1 to 4	PY27/7W/1
H14/1 to 4	R2/1 to 3
H15/1 to 5	R5W/1
H16/1 to 4	R10W/1
H6W/1	S1/S2/1 to 2
H10W/1 to 2	S3/1
H21W/1 to 2	T1.4W/1
H27W/1 to 3	T4W/1
HB3/1 to 4	W2.3W/1
HB4/1 to 4	W3W/1
HIR1/1 to 3	W5W/1
HIR2/1 to 3	W15/5W/1 to 3
HS1/1 to 5	W16W/1
HS2/1 to 3	W21W/1 to 2
HS5/1 to 4	W21/5W/1 to 3
HS5A/1 to 3	WP21W/1 to 2
HS6/1 to 4	WR21/5W/1
P13W/1 to 3	WY2.3W/1
P19W/1 to 3	WY21W/1 to 2
P21W/1 to 2	
P21/4W/1	

CATEGORY C5W — Sheet C5W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
b ⁽¹⁾	34,0	35,0	36,0	35,0 ± 0,5
f ⁽²⁾ ⁽³⁾	7,5 ⁽⁴⁾		15 ⁽⁵⁾	9 ± 1,5

Cap SV8,5 in accordance with IEC Publication 60061 (sheet 7004-81-4)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS					
Rated values	Volts	6	12	24	12
	Watts	5			5
Test voltage	Volts	6,75	13,5	28,0	13,5
Objective values	Watts	5,5 max.		7,7 max.	5,5 max.
	Luminous flux	45 ± 20 %			

Reference luminous flux: 45 lm at approximately 13,5 V

⁽¹⁾ This dimension corresponds to a distance between two apertures of 3,5 mm diameter each bearing against one of the caps.

⁽²⁾ The filament shall be housed in a cylinder 19 mm long co-axial with the filament lamp and placed symmetrically about the filament lamp centre.
The diameter of the cylinder is for 6 V and 12 V filament lamps: d + 4 mm (for standard filament lamps: d + 2 mm) and for 24 V filament lamps: d + 5 mm, 'd' being the nominal diameter of the filament as stated by the manufacturer.

⁽³⁾ The deviation of the filament centre from the centre of the filament lamp shall not be more than ± 2,0 mm (for standard filament lamps: ± 0,5 mm) measured in the direction of the reference axis.

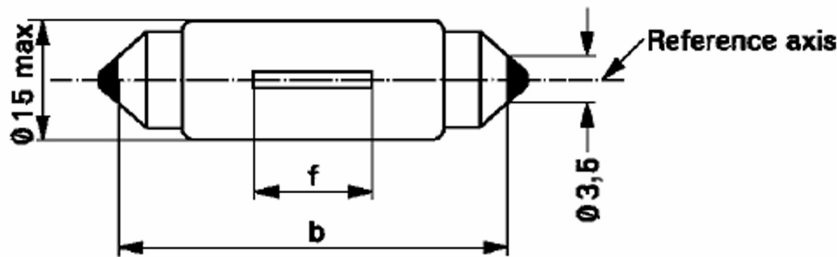
⁽⁴⁾ 4,5 mm for 6 V filament lamps.

⁽⁵⁾ 16,5 mm for 24 V filament lamps.

CATEGORY C21W — Sheet C21W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

FILAMENT LAMP FOR REVERSING LAMP ONLY



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
b ⁽¹⁾	40,0	41,0	42,0	41,0 ± 0,5
f ⁽²⁾	7,5		10,5	8 ± 1,0

Cap SV8,5 in accordance with IEC Publication 60061 (sheet 7004-81-4)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	21	21
Test voltage	Volts	13,5	13,5
Objective values	Watts	26,5 max.	26,5 max.
	Luminous flux	460 ± 15 %	

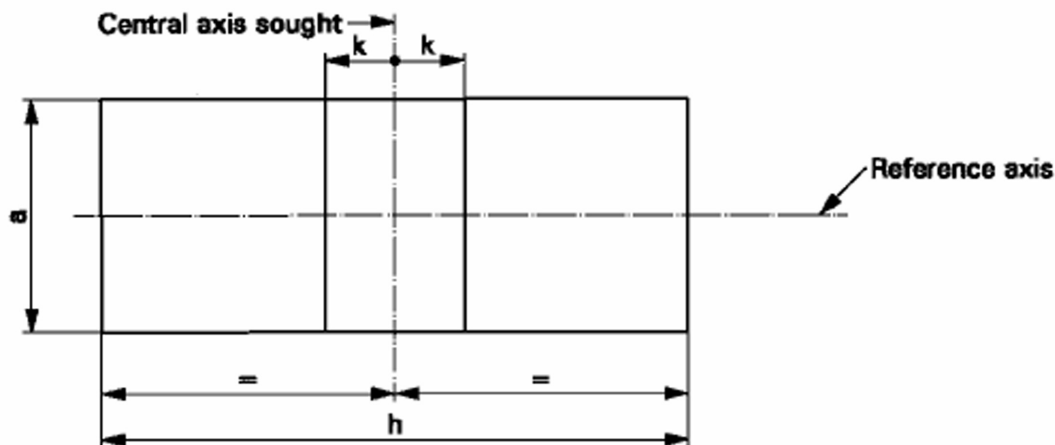
Reference luminous flux: 460 lm at approximately 13,5 V

⁽¹⁾ This dimension corresponds to a distance between two apertures of 3,5 mm diameter.
⁽²⁾ The position of the filament is checked by means of a 'Box-System'; sheet C21W/2.

CATEGORY C21W — Sheet C21W/2

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and to the centre of the filament lamp's length, whether a filament lamp complies with the requirements.



12 V	a	h	k
filament lamps of normal production	4,0 + d	14,5	2,0
standard filament lamp	2,0 + d	14,5	0,5

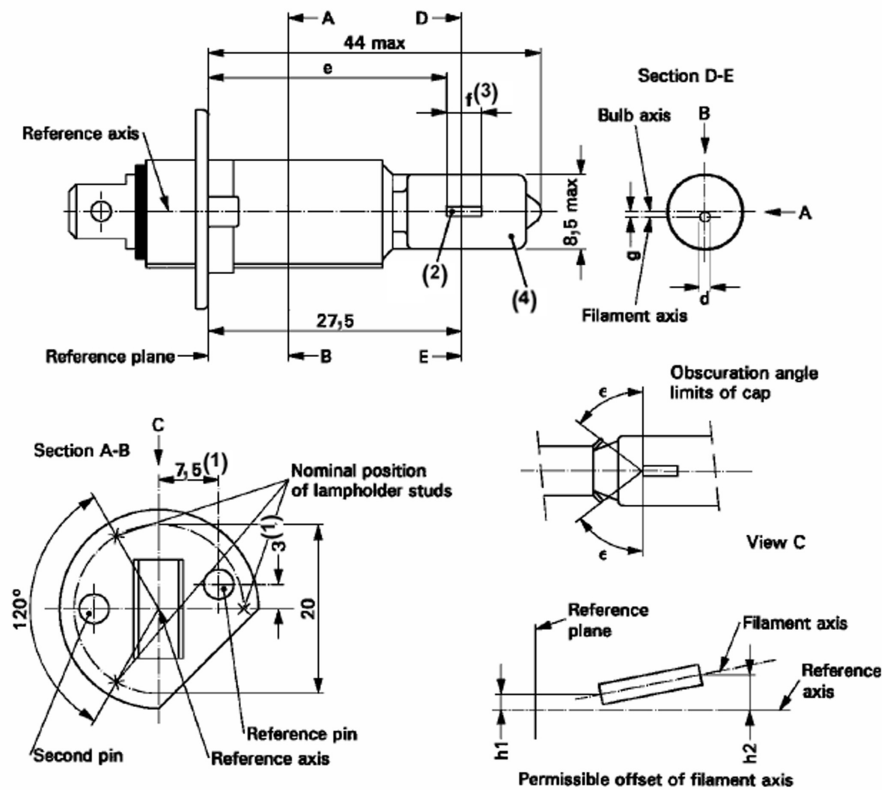
d = nominal filament diameter as stated by the manufacturer.

Test procedure and requirements

1. The filament lamp is placed in a holder (socket) capable of being so rotated through 360° about the reference axis that the front elevation is seen on the screen on to which the image of the filament is projected. The reference plane on the screen shall coincide with the centre of the filament lamp. The central axis sought on the screen shall coincide with the centre of the filament lamp length.
 2. Front elevation
 - 2.1. The projection of the filament shall lie entirely within the rectangle when the filament lamp is rotated through 360°.
 - 2.2. The centre of the filament shall not be offset by more than distance 'k' from the central axis sought.

CATEGORY H1 — Sheet H1/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



⁽¹⁾ The reference axis is perpendicular to the reference plane and passes through the point defined by the dimensions marked with ⁽¹⁾.

⁽²⁾ Both current lead-in electrodes shall be positioned in the bulb, the longer electrode above the filament (the filament lamp being viewed as shown in the figure). The internal design should be then such that stray light images and reflections are reduced to the minimum, e.g. by fitting cooling jackets over the non-coiled parts of the filament.

⁽³⁾ The cylindrical portion of the bulb over length 'f' shall be such as not to deform the projected image of the filament to such an extent as appreciably to affect the optical results.

⁽⁴⁾ The colour of the light emitted shall be white or selective-yellow.

CATEGORY H1 — Sheet H1/2

Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	6 V	12 V	24 V	12 V
e ⁽⁶⁾ ⁽¹⁰⁾	25,0 ⁽⁹⁾			25,0 ± 0,15
f ⁽⁶⁾ ⁽¹⁰⁾	4,5 ± 1,0	5,0 ± 0,5	5,5 ± 1,0	5,0 + 0,50 / – 0,00
g ⁽⁷⁾ ⁽⁸⁾	0,5 d ± 0,5 d			0,5 d ± 0,25 d
h1	⁽⁹⁾			0 ± 0,20 ⁽⁵⁾
h2	⁽⁹⁾			0 ± 0,25 ⁽⁵⁾
ε	45° ± 12°			45° ± 3°

Cap P14,5s in accordance with IEC Publication 60061 (sheet 7004-46-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	6	12	24	12
	Watts	55		70	55
Test Voltage	Volts	6,3	13,2	28,0	13,2
Objective values	Watts	63 max.	68 max.	84 max.	68 max.
	Luminous flux ± %	1 350	1 550	1 900	
		15			
Reference luminous flux at approximately				12 V	1 150
				13,2 V	1 550

⁽⁵⁾ The eccentricity is measured only in the horizontal and vertical directions of the filament lamp as shown in the figure. The points to be measured are those where the projections of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

⁽⁶⁾ The viewing direction is the perpendicular to the reference axis contained in the plane defined by the reference axis and the centre of the second pin of the cap.

⁽⁷⁾ Offset of filament in relation to bulb axis measured at 27,5 mm from the reference plane.

⁽⁸⁾ d: diameter of filament.

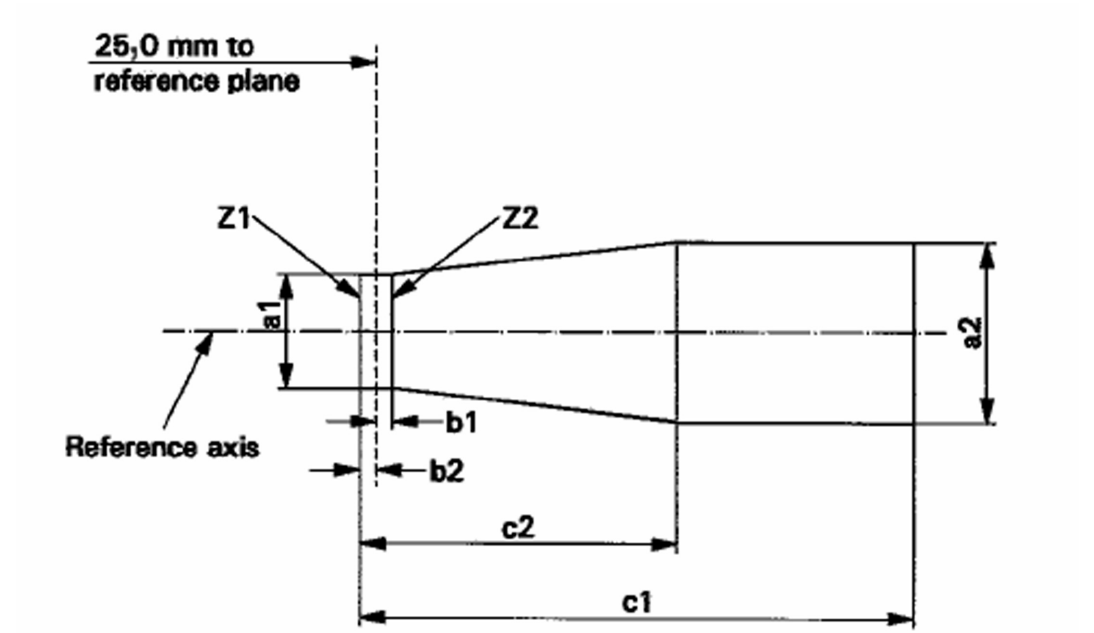
⁽⁹⁾ To be checked by means of a 'Box System', sheet H1/3.

⁽¹⁰⁾ The ends of the filament are defined as the points where, when the viewing direction is as defined in note 6 above, the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the reference axis.(special instructions for coiled-coil filaments are under consideration).

CATEGORY H1 — Sheet H1/3

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



	a1	a2	b1	b2	c1	c2
6 V	1,4 d	1,9 d	0,25		6	3,5
12 V					6	4,5
24 V					7	4,5

d = diameter of filament.

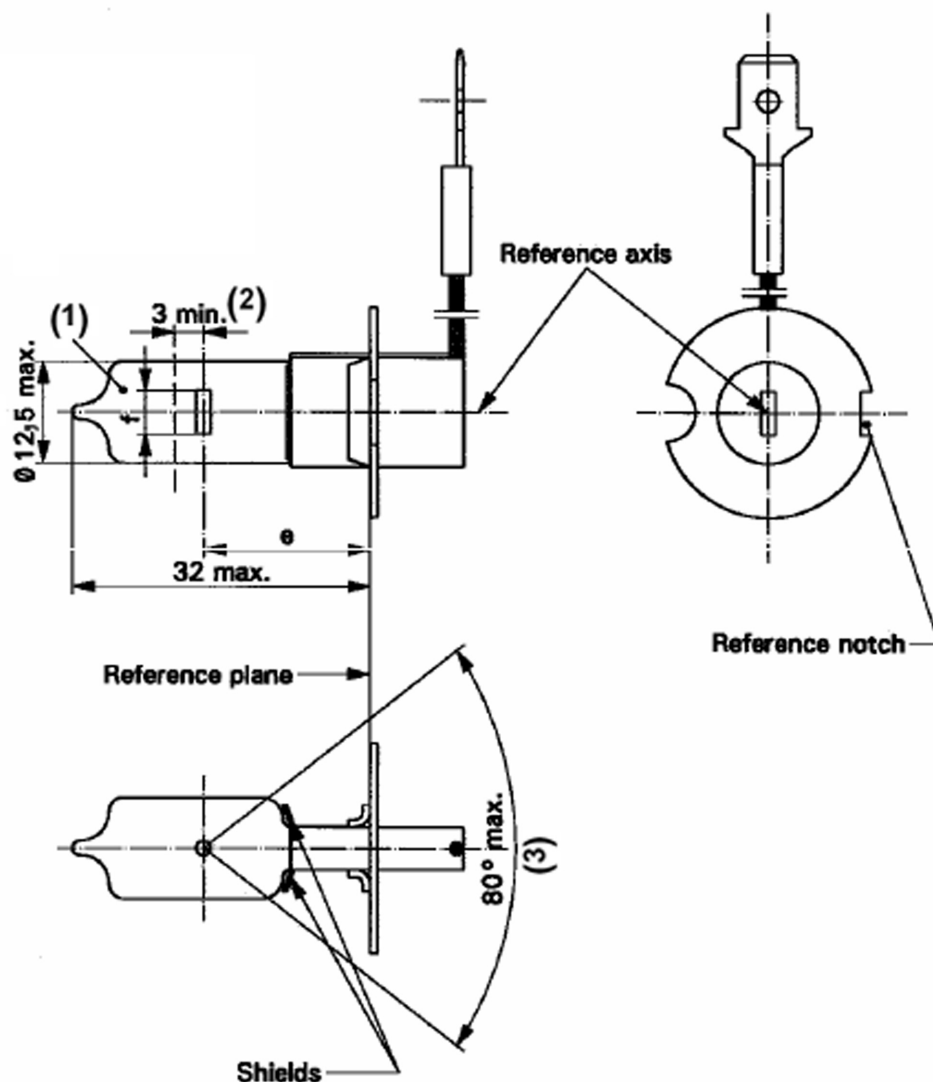
The filament position is checked solely in directions A and B as shown on sheet H1/1.

The filament shall lie entirely within the limits shown.

The beginning of the filament as defined on sheet H1/2, note 10, shall lie between lines Z1 and Z2.

CATEGORY H3 — Sheet H3/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

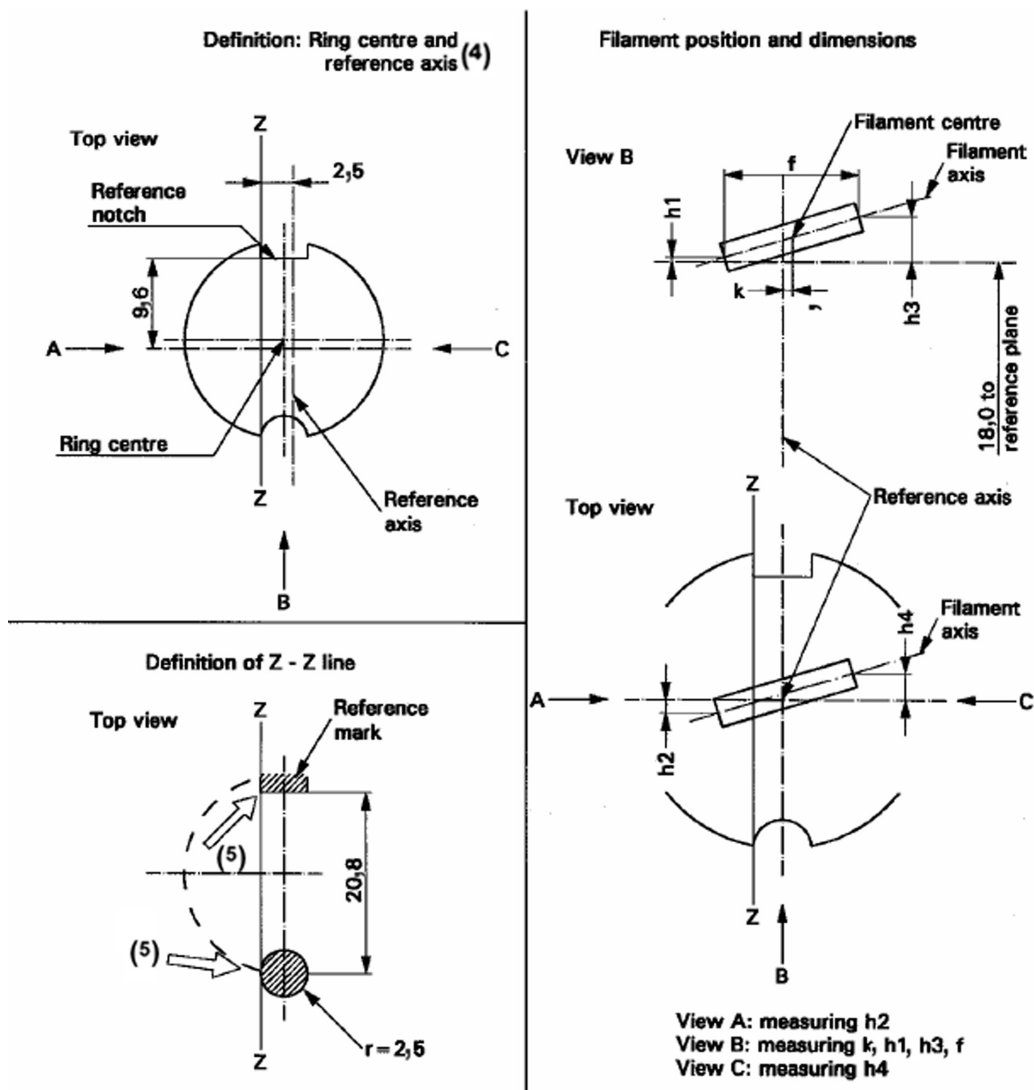


(¹) The colour of the light emitted shall be white or selective-yellow.

(²) Minimum length above the height of the light emitting centre ('e') over which the bulb shall be cylindrical.

(³) The distortion of the base-end portion of the bulb shall not be visible from any direction outside the obscuration angle of 80° max. The shields shall produce no inconvenient reflections. The angle between the reference axis and the plane of each shield, measured on the bulb side, shall not exceed 90° .

CATEGORY H3 — Sheet H3/2



⁽⁴⁾ The permissible deviation of the ring centre from the reference axis is 0,5 mm in the direction perpendicular to the Z-Z line and 0,05 mm in the direction parallel to the Z-Z line.

⁽⁵⁾ The cap shall be pressed in these directions.

CATEGORY H3 — Sheet H3/3

Dimensions in mm	Filaments lamps of normal production			Standard filament lamp
	6 V	12 V	24 V	12 V
e	18,0 ⁽⁶⁾			18,0
f ⁽⁸⁾	3,0 min.	4,0 min.		5,0 ± 0,50
k	0 ⁽⁶⁾			0 ± 0,20
h1, h3	0 ⁽⁶⁾			0 ± 0,15 ⁽⁷⁾
h2, h4	0 ⁽⁶⁾			0 ± 0,25 ⁽⁷⁾

Cap PK22s in accordance with IEC Publication 60061 (sheet 7004-47-4)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	6	12	24	12
	Watts	55		70	55
Test voltage	Volts	6,3	13,2	28,0	13,2
Objective values	Watts	63 max.	68 max.	84 max.	68 max.
	Luminous flux ± %	1 050	1 450	1 750	
		15			
Reference luminous flux at approximately				12 V	1 100
				13,2 V	1 450

⁽⁶⁾ To be checked by means of a 'Box-System'; sheet H3/4.

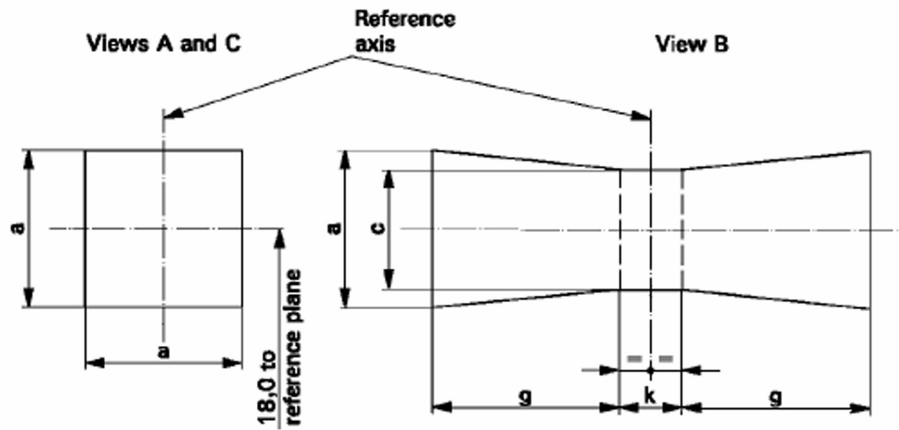
⁽⁷⁾ For standard filament lamps the points to be measured are those where the projection of the outside of the end turns crosses the filament axis.

⁽⁸⁾ The positions of the first and the last turn of the filament are defined by the intersections of the outside of the first and of the last light emitting turn, respectively, with the plane parallel to and 18 mm distant from the reference plane. (Additional instructions for coiled-coil filament are under consideration).

CATEGORY H3 — Sheet H3/4

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament complies with the requirements.



	a	c	k	g
6 V	1,8 d	1,6 d	1,0	2,0
12 V				2,8
24 V				2,9

d = diameter of filament

The filament shall lie entirely within the limits shown.

The centre of the filament shall lie within the limits of dimension k.

CATEGORY H4 — Sheet H4/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

Figure 1

Main drawing

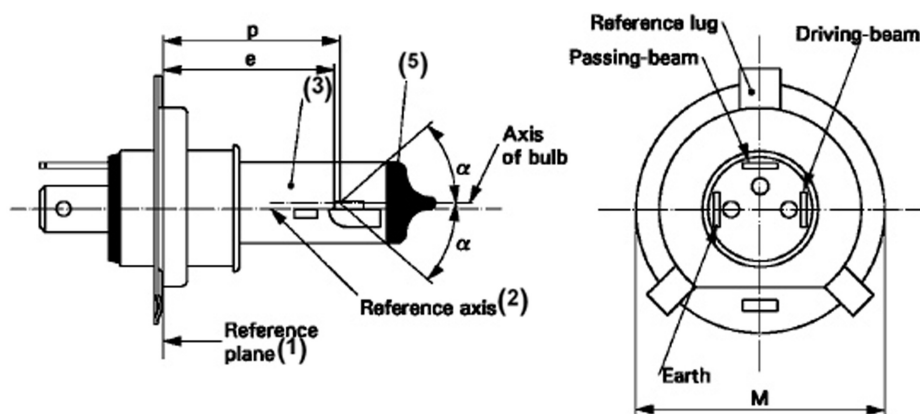


Figure 2

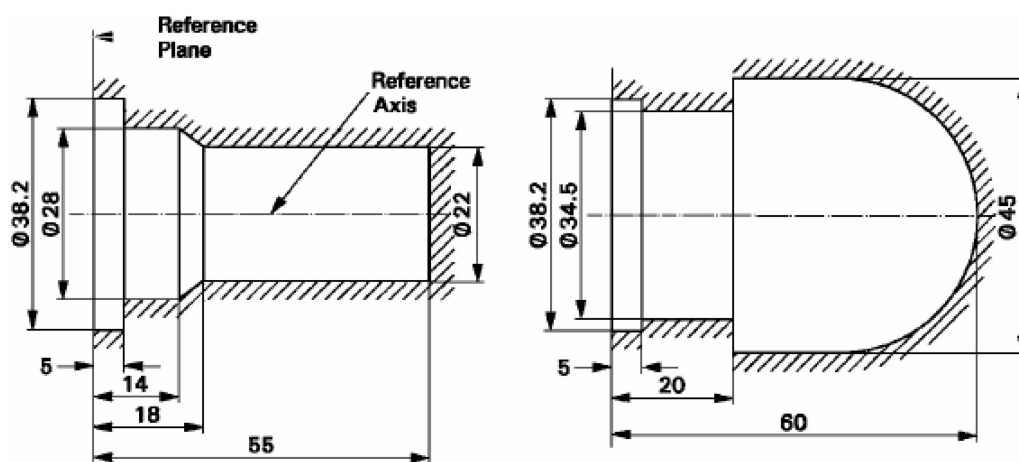
Maximum lamp outlines ⁽⁴⁾

Figure 3

- ⁽¹⁾ The reference plane is the plane formed by the seating points of the three lugs of the cap ring.
- ⁽²⁾ The reference axis is perpendicular to the reference plane and passes through the centre of the circle of diameter 'M'.
- ⁽³⁾ The colour of the light emitted shall be white or selective-yellow.
- ⁽⁴⁾ The bulb and supports shall not exceed the envelope as in Figure 2. However, where a selective-yellow outer bulb is used the bulb and supports shall not exceed the envelope as in Figure 3.
- ⁽⁵⁾ The obscuration shall extend at least as far as the cylindrical part of the bulb. It shall also overlap the internal shield when the latter is viewed in a direction perpendicular to the reference axis.

CATEGORY H4 — Sheet H4/2

Dimensions in mm	Filament lamps of normal production		Standard filament lamp
	12 V	24 V	12 V
e	28,5 + 0,35 / - 0,25	29,0 ± 0,35	28,5 + 0,20 / - 0,00
p	28,95	29,25	28,95
α	max. 40°		max.40°

Cap P43t in accordance with IEC Publication 60061 (sheet 7004-39-6)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

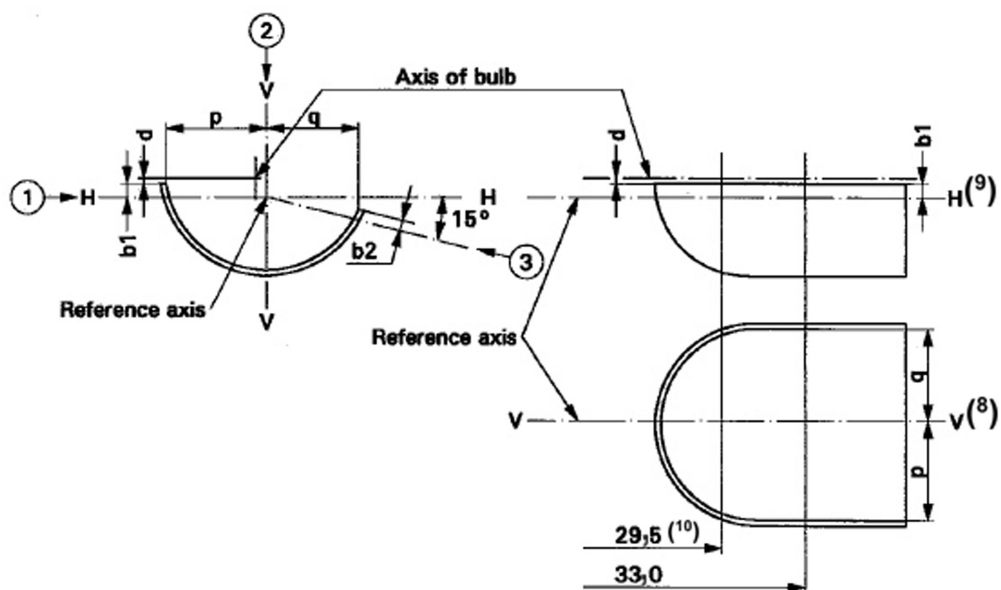
Rated values	Volts	12 ⁽⁶⁾		24 ⁽⁶⁾		12 ⁽⁶⁾	
	Watts	60	55	75	70	60	55
Test voltage	Volts	13,2		28,0		13,2	
Objective values	Watts	75 max.	68 max.	85 max.	80 max.	75 max.	68 max.
	Luminous flux ± %	1 650	1 000	1 900	1 200		
		15					
Measuring flux (lm) ⁽⁷⁾		—	750	—	800		
Reference luminous flux at approximately					12 V	1 250	750
					13,2 V	1 650	1 000

⁽⁶⁾ The value indicated in the left hand column relate to the driving-beam filament. Those indicated in the right-hand column relate to the passing beam filament.

⁽⁷⁾ Measuring luminous flux for measuring according to paragraph 3.9 of this Regulation.

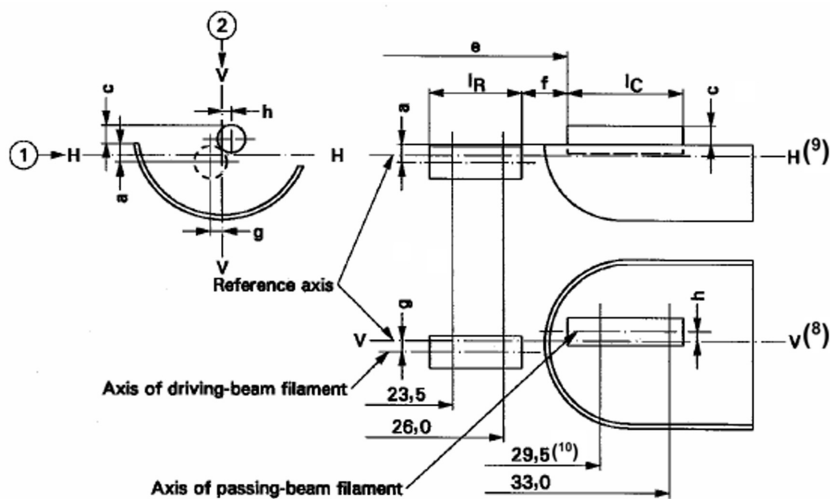
CATEGORY H4 — Sheet H4/3

Position of shield



The drawing is not mandatory with respect to the design of the shield.

Position of filaments



CATEGORY H4 — Sheet H4/4

Table of the dimensions (in mm) referred to in the drawings on sheet H4/3

Reference (*)		Dimension (**)		Tolerance		
				Filaments lamps of normal production		Standard filament lamp
12 V	24 V	12 V	24 V	12 V	24 V	12 V
a/26		0,8		± 0,35		± 0,20
a/23,5		0,8		± 0,60		± 0,20
b1/29,5	30,0	0		± 0,30	± 0,35	± 0,20
b1/33		b1/29,5 mv	b1/30,0 mv	± 0,30	± 0,35	± 0,15
b2/29,5	30,0	0		± 0,30	± 0,35	± 0,20
b2/33		b1/29,5 mv	b2/30,0 mv	± 0,30	± 0,35	± 0,15
c/29,5	30,0	0,6	0,75	± 0,35		± 0,20
c/33		c/29,5 mv	c/30,0 mv	± 0,35		± 0,15
d		min. 0,1		—		—
e ⁽¹³⁾		28,5	29,0	+ 0,35 - 0,25	± 0,35	+ 0,20 - 0,00
f ⁽¹¹⁾ ⁽¹²⁾ ⁽¹³⁾		1,7	2,0	+ 0,50 - 0,30	± 0,40	+ 0,30 - 0,10
g/26		0		± 0,50		± 0,30
g/23,5		0		± 0,70		± 0,30
h/29,5	30,0	0		± 0,50		± 0,30
h/33		h/29,5 mv	h/30,0 mv	± 0,35		± 0,20
IR ⁽¹¹⁾ ⁽¹⁴⁾		4,5	5,25	± 0,80		± 0,40
IC ⁽¹¹⁾ ⁽¹²⁾		5,5	5,25	± 0,50	± 0,80	± 0,35
p/33		Depends on the shape of the shield		—		—
q/33		(p + q) / 2		± 0,60		± 0,30

(*) '.../26' means dimension to be measured at the distance from the reference plane indicated in mm after the stroke.

(**) '29,5 mv' or '30,0 mv' means the value measured at a distance of 29,5 or 30,0 mm from the reference plane.

(8) Plane V-V is the plane perpendicular to the reference plane and passing through the reference axis and through the intersection of the circle of diameter 'M' with the axis of the reference lug.

(9) Plane H-H is the plane perpendicular to both the reference plane and plane V-V and passing through the reference axis.

(10) 30,0 mm for the 24-Volt type.

(11) The end turns of the filament are defined as being the first luminous turn and the last luminous turn that are at substantially the correct helix angle. For coiled-coil filaments, the turns are defined by the envelope of the primary coil.

(12) For the passing-beam filament, the points to be measured are the intersections, seen in direction 1, of the lateral edge of the shield with the outside of the end turns defined under footnote 11.

(13) 'e' denotes the distance from the reference plane to the beginning of the passing beam filament as defined above.

(14) For the driving-beam filament the points to be measured are the intersections, seen in direction 1, of a plane, parallel to plane H-H and situated at a distance of 0,8 mm below it, with the end turns defined under footnote 11.

CATEGORY H4 — Sheet H4/5*Additional explanations to sheet H4/3*

The dimensions below are measured in three directions:

- (1) for dimensions a, b1, c, d, e, f, lR and lC;
- (2) for dimensions g, h, p and q;
- (3) for dimension b2.

Dimensions p and q are measured in planes parallel to and 33 mm away from the reference plane.

Dimensions b1, b2, c and h are measured in planes parallel to and 29,5 mm (30,0 mm for 24 V filament lamps) and 33 mm away from the reference plane.

Dimensions a and g are measured in planes parallel to and 26,0 mm and 23,5 mm away from the reference plane.

Note: For the method of measurement, see Appendix E of IEC Publication 60809.

CATEGORY H7 — Sheet H7/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp

Figure 1

Main drawing

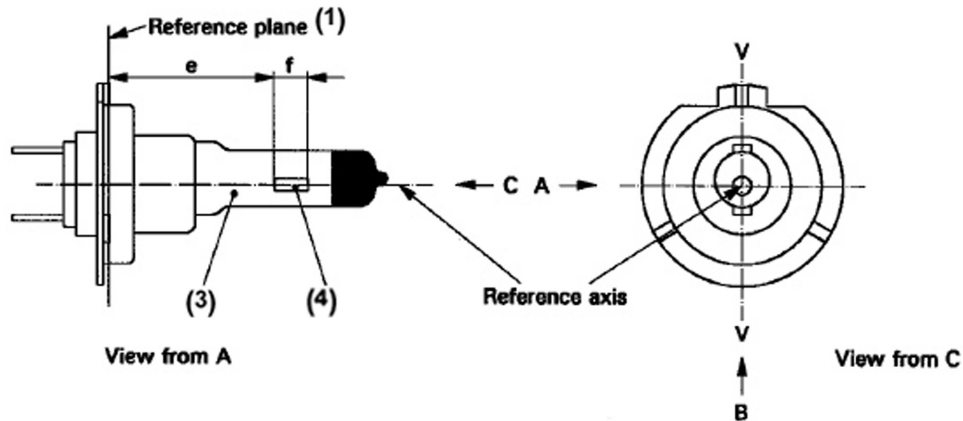


Figure 2

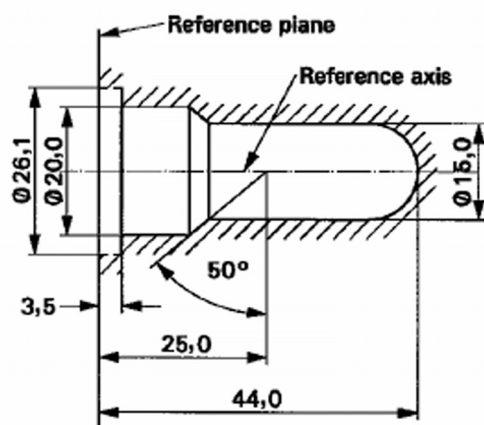
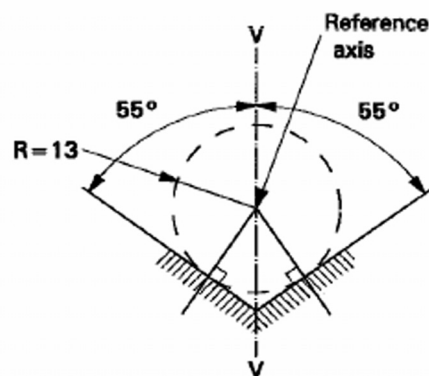
Maximum lamp outline ⁽⁵⁾

Figure 3

Definition of reference axis ⁽²⁾

- ⁽¹⁾ The reference plane is defined by the points on the surfaces of the holder on which the three supporting bosses of the cap ring will rest.
- ⁽²⁾ The reference axis is perpendicular to the reference plane and crosses the intersection of the two perpendiculars as indicated in Figure 3.
- ⁽³⁾ The colour of the light emitted shall be white or selective-yellow.
- ⁽⁴⁾ Notes concerning the filament diameter.
- (a) No actual diameter restrictions apply but the objective for future developments is to have $d_{\text{max.}} = 1,3 \text{ mm}$ for 12 V and $d_{\text{max.}} = 1,7$ for 24V filament lamps.
- (b) For the same manufacturer, the design diameter of standard (étalon) filament lamp and filament lamp of normal production shall be the same.
- ⁽⁵⁾ Glass bulb and supports shall not exceed the envelope as indicated in Figure 2. The envelope is concentric to the reference axis.

CATEGORY H7 — Sheet H7/2

Figure 4

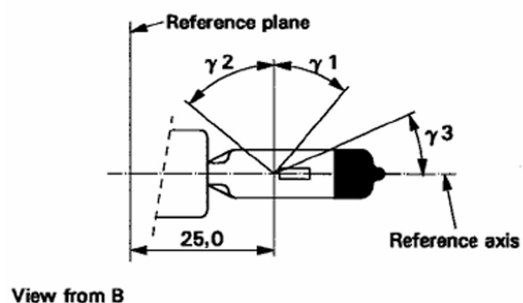
Distortion free area ⁽⁶⁾ and black top ⁽⁷⁾

Figure 5

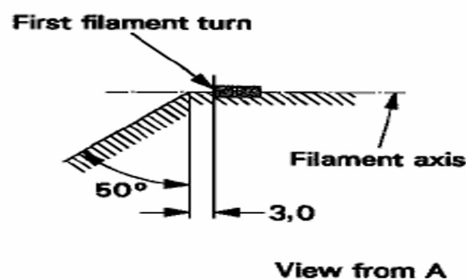
Metal free zone ⁽⁸⁾

Figure 6

Permissible offset of filament axis ⁽⁹⁾

(for standard filament lamps only)

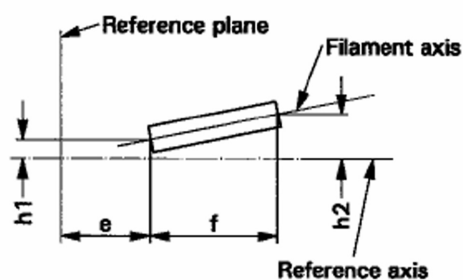
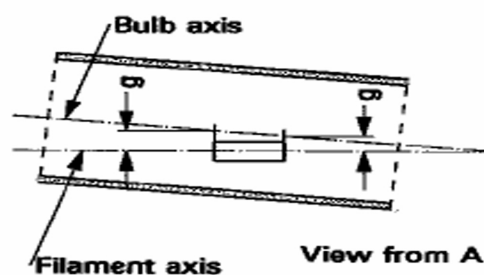


Figure 7

Bulb eccentricity



⁽⁶⁾ Glass bulb shall be optically distortion free within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 .

⁽⁷⁾ The obscuration shall extend at least to the cylindrical part of the bulb on the whole bulb top circumference. It shall moreover extend at least to a plane parallel to the reference plane where 3 crosses the outer bulb surface (view B as indicated on sheet H7/1).

⁽⁸⁾ The internal design of the lamp shall be such that stray light images and reflections are only located above the filament itself seen from the horizontal direction. (View A as indicated in Figure 1 on sheet H7/1).

No metal parts other than filament turns shall be located in the shaded area as seen in Figure 5.

CATEGORY H7 — Sheet H7/3

Dimensions in mm	Filaments lamps of normal production		Standard filament lamp
	12 V	24 V	12 V
e ⁽⁹⁾	25,0 ⁽¹⁰⁾		25,0 ± 0,1
f ⁽⁹⁾	4,1 ⁽¹⁰⁾	4,9 ⁽¹⁰⁾	4,1 ± 0,1
g ⁽¹²⁾	0,5 min.		under consideration
h1 ⁽¹¹⁾	0 ⁽¹⁰⁾		0 ± 0,10
h2 ⁽¹¹⁾	0 ⁽¹⁰⁾		0 ± 0,15
γ ¹	40° min.		40° min.
γ ²	50° min.		50° min.
γ ³	30° min.		30° min.

Cap PX26d in accordance with IEC Publication 60061 (sheet 7004-5-6)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	24	12
	Watts	55	70	55
Test voltage	Volts	13,2	28,0	13,2
Objective values	Watts	58 max.	75 max.	58 max.
	Luminous flux	1 500 ± 10 %	1 750 ± 10 %	
Reference luminous flux at approximately			12 V	1 100
			13,2 V	1 500

⁽⁹⁾ The ends of the filament are defined as the points where, when the viewing direction is direction A as shown in Figure 1 on sheet H7/1, the projection of the outside of the end turns crosses the filament axis. (Special instructions for coiled-coil filaments are under consideration).

⁽¹⁰⁾ To be checked by means of a 'Box System', sheet H7/4.

⁽¹¹⁾ The offset of the filament with respect to the reference axis is measured only in viewing directions A and B as shown in Figure 1 in sheet H7/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

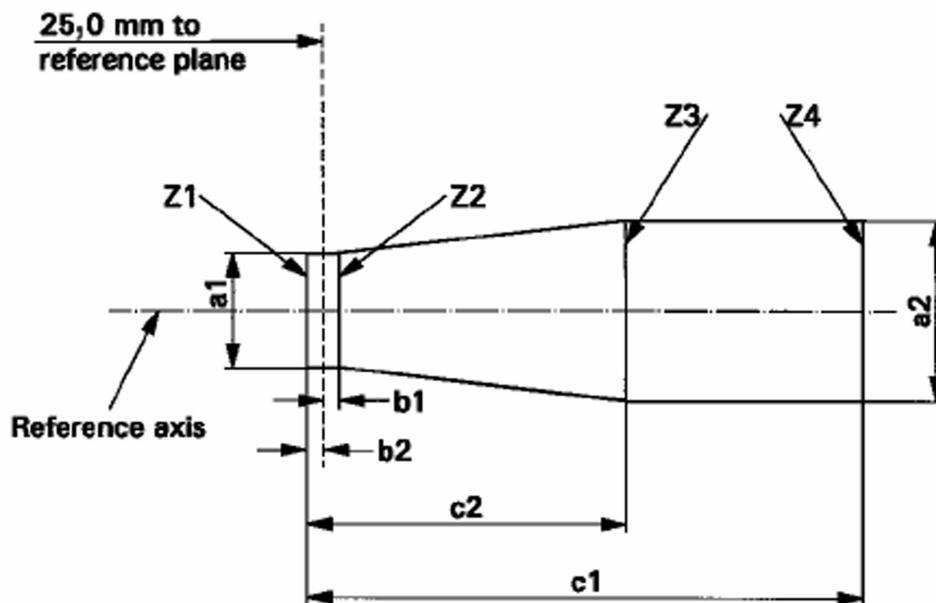
⁽¹²⁾ Offset of filament in relation to bulb axis measured in two planes parallel to the reference plane where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

CATEGORY H7 — Sheet H7/4

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.

(Dimensions in mm)



	a1	a2	b1	b2	c1	c2
12 V	$d + 0,30$	$d + 0,50$	0,2		4,6	4,0
24 V	$d + 0,60$	$d + 1,00$	0,25		5,9	4,4

d = diameter of filament

The filament position is checked solely in directions A and B as shown on sheet H7/1, Figure 1.

The filament shall lie entirely within the limits shown.

The ends of the filament as defined on sheet H7/3, note 9, shall lie between lines Z1 and Z2 and between Z3 and Z4.

CATEGORIES H8 AND H8B — Sheet H8/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

Figure 1

Main drawings

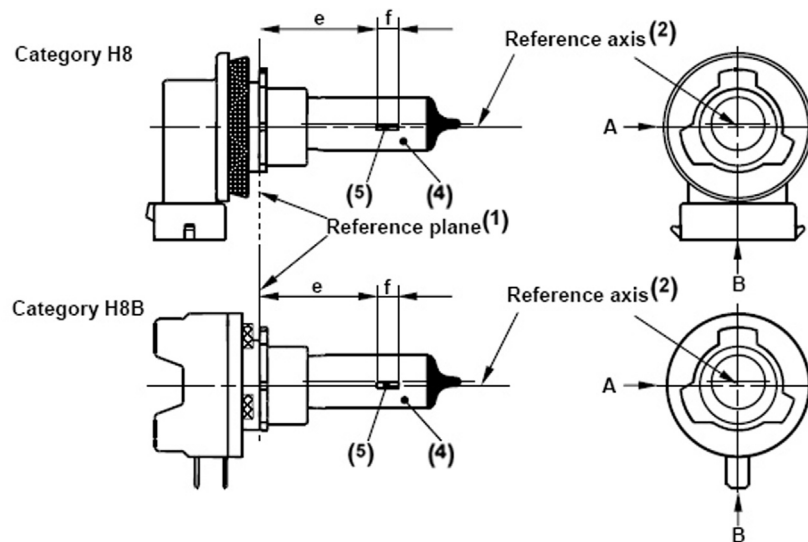
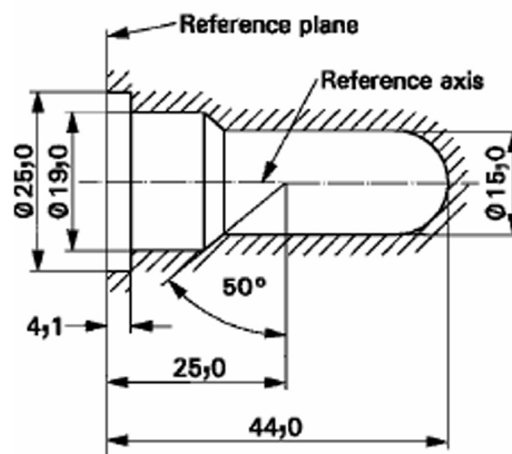


Figure 2

Maximum lamp outline ⁽³⁾

⁽¹⁾ The reference plane is the plane formed by the underside of the bevelled lead-in flange of the cap.

⁽²⁾ The reference axis is perpendicular to the reference plane and passing through the centre of the 19 mm cap diameter.

⁽³⁾ Glass bulb and supports shall not exceed the envelope as indicated in Figure 2. The envelope is concentric to the reference axis.

⁽⁴⁾ The colour of the light emitted shall be white or selective-yellow.

⁽⁵⁾ Notes concerning the filament diameter.

(a) No actual diameter restrictions apply but the objective for future developments is to have $d_{\max.} = 1,2$ mm.

(b) For the same manufacturer, the design diameter of standard (étalon) filament lamp and filament lamp of normal production shall be the same.

CATEGORIES H8 AND H8B — Sheet H8/2

Figure 3

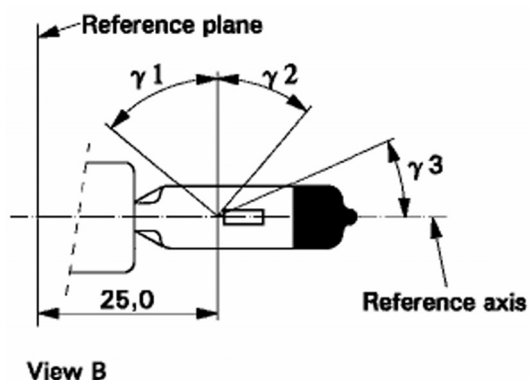
Distortion free area ⁽⁶⁾ and black top ⁽⁷⁾

Figure 4

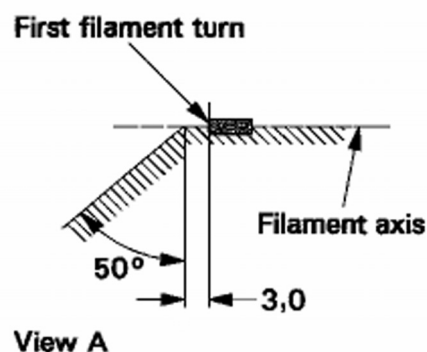
Metal free zone ⁽⁸⁾

Figure 5

Permissible offset of filament axis ⁽⁹⁾

(for standard filament lamps only)

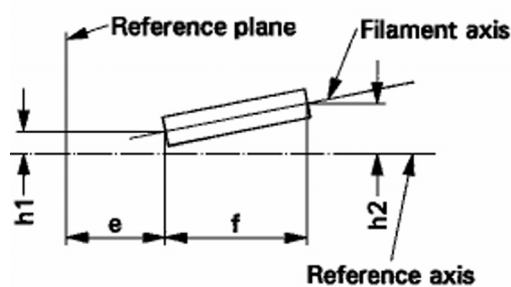
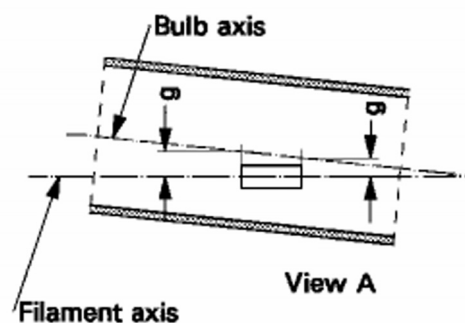


Figure 6

Bulb eccentricity ⁽¹⁰⁾

- ⁽⁶⁾ Glass bulb shall be optically distortion free within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 .
- ⁽⁷⁾ The obscuration shall extend at least to the cylindrical part of the bulb on the whole bulb top circumference. It shall moreover extend at least to a plane parallel to the reference plane where γ_3 crosses the outer bulb surface (view B as indicated on sheet H8/1).
- ⁽⁸⁾ The internal design of the lamp shall be such that stray light images and reflections are only located above the filament itself seen from the horizontal direction. (View A as indicated in Figure 1 on sheet H8/1). No metal parts other than filament turns shall be located in the shaded area as seen in Figure 4.
- ⁽⁹⁾ The offset of the filament with respect to the reference axis is measured only in viewing directions A and B as shown in Figure 1 in sheet H8/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.
- ⁽¹⁰⁾ Offset of filament in relation to bulb axis measured in two planes parallel to the reference plane where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

CATEGORIES H8 AND H8B — Sheet H8/3

Dimensions in mm	Filaments lamps of normal production	Standard filament lamp
	12 V	12 V
e ⁽¹¹⁾	25,0 ⁽¹²⁾	25,0 ± 0,1
f ⁽¹¹⁾	3,7 ⁽¹²⁾	3,7 ± 0,1
g	0,5 min.	under consideration
h1	0 ⁽¹²⁾	0 ± 0,1
h2	0 ⁽¹²⁾	0 ± 0,15
γ ¹	50° min.	50° min.
γ ²	40° min.	40° min.
γ ³	30° min.	30° min.

Cap: H8: PGJ19-1 in accordance with IEC Publication 60061 (sheet 7004-110-2)
H8B: PGJY19-1 in accordance with IEC Publication 60061 (sheet 7004-146-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	35	35
Test voltage	Volts	13,2	13,2
Objective values	Watts	43 max.	43 max.
	Luminous flux	800 ± 15 %	
Reference luminous flux at approximately	12 V		600
	13,2 V		800

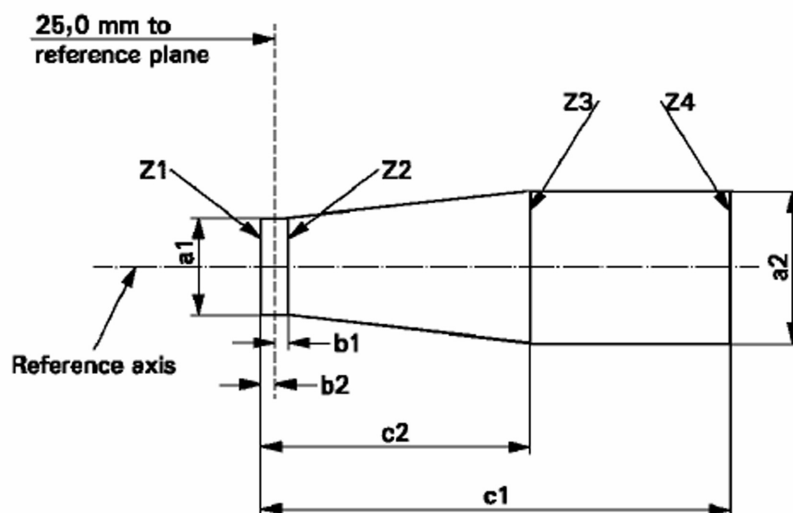
⁽¹¹⁾ The ends of the filament are defined as the points where, when the viewing direction is direction A as shown in Figure 1 on sheet H8/1, the projection of the outside of the end turns crosses the filament axis.

⁽¹²⁾ To be checked by means of a 'Box System'; sheet H8/4.

CATEGORIES H8 AND H8B — Sheet H8/4

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament complies with the requirements.



a1	a2	b1	b2	c1	c2
$d + 0,50$	$d + 0,70$	0,25		4,6	3,5

d = diameter of filament

The filament position is checked solely in directions A and B as shown on sheet H8/1, Figure 1.

The filament shall lie entirely within the limits shown.

The ends of the filament as defined on sheet H8/3, note 11, shall lie between lines Z1 and Z2 and between Z3 and Z4.

CATEGORIES H9 AND H9B — Sheet H9/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

Figure 1

Main drawings

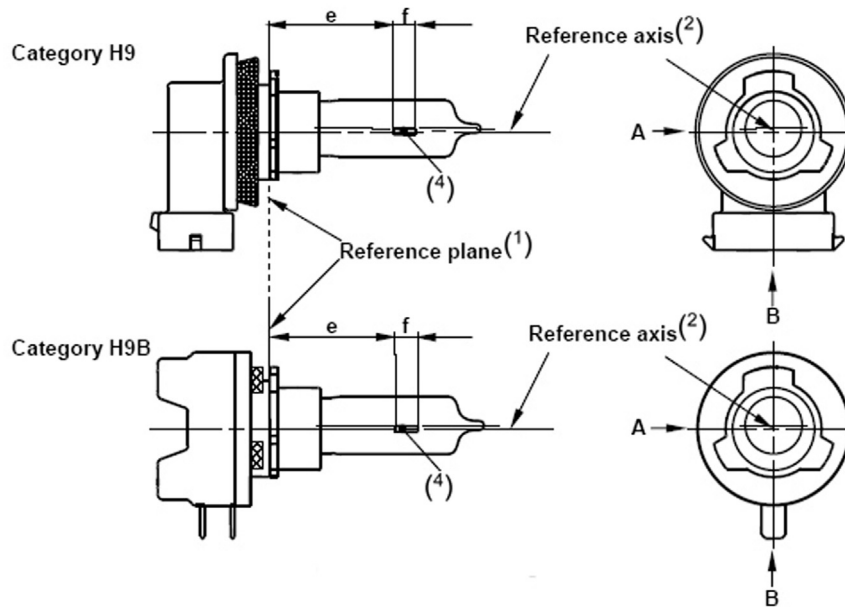
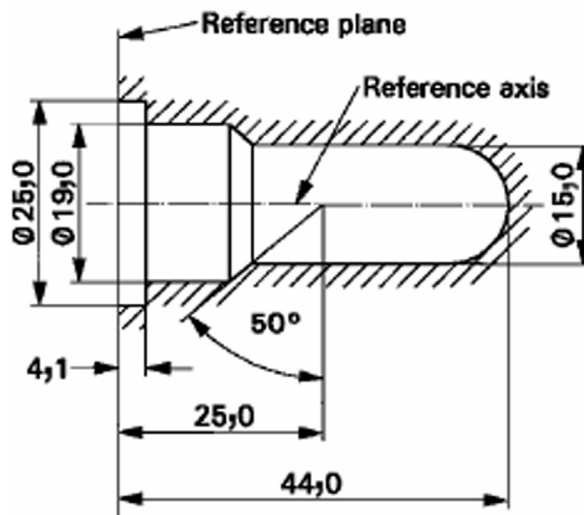


Figure 2

Maximum lamp outline ⁽³⁾

⁽¹⁾ The reference plane is the plane formed by the underside of the bevelled lead-in flange of the cap.

⁽²⁾ The reference axis is perpendicular to the reference plane and passing through the centre of the 19 mm cap diameter.

⁽³⁾ Glass bulb and supports shall not exceed the envelope as indicated in Figure 2. The envelope is concentric to the reference axis.

⁽⁴⁾ Notes concerning the filament diameter.

(a) No actual diameter restrictions apply but the objective for future developments is to have $d_{\text{max}} = 1,4$ mm.

(b) For the same manufacturer, the design diameter of standard (étalon) filament lamp and filament lamp of normal production shall be the same.

CATEGORIES H9 AND H9B — Sheet H9/2

Figure 3

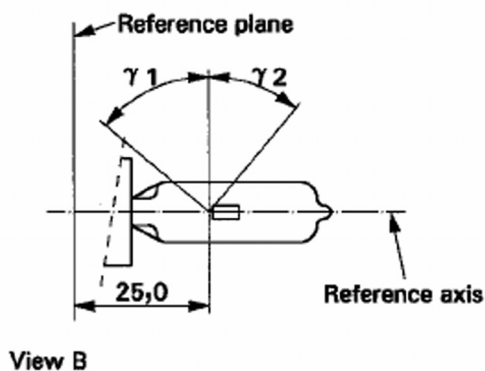
Distortion free area ⁽⁵⁾

Figure 4

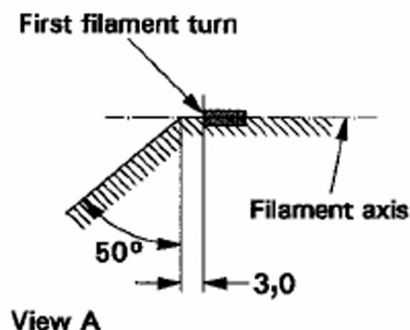
Metal free zone ⁽⁶⁾

Figure 5

Permissible offset of filament axis ⁽⁷⁾

(for standard filament lamps only)

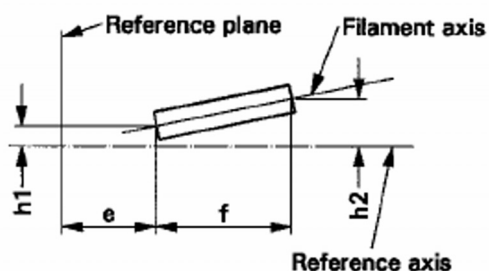
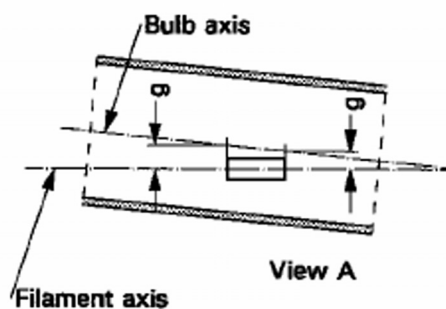


Figure 6

Bulb eccentricity ⁽⁸⁾

⁽⁵⁾ Glass bulb shall be optically distortion free within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 .

⁽⁶⁾ The internal design of the lamp shall be such that stray light images and reflections are only located above the filament itself seen from the horizontal direction. (View A as indicated in Figure 1, sheet H9/1). No metal parts other than filament turns shall be located in the shaded area as seen in Figure 4.

⁽⁷⁾ The offset of the filament with respect to the reference axis is measured only in viewing directions A and B as shown in Figure 1 on sheet H9/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

⁽⁸⁾ Offset of filament in relation to bulb axis measured in two planes parallel to the reference plane where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

CATEGORIES H9 AND H9B — Sheet H9/3

Dimensions in mm		Tolerances	
		Filaments lamps of normal production	Standard filament lamp
		12 V	12 V
e ⁽⁹⁾ ⁽¹⁰⁾	25	⁽¹¹⁾	± 0,10
f ⁽⁹⁾ ⁽¹⁰⁾	4,8	⁽¹¹⁾	± 0,10
g ⁽⁹⁾	0,7	± 0,5	± 0,30
h1	0	⁽¹¹⁾	± 0,10 ⁽¹²⁾
h2	0	⁽¹¹⁾	± 0,15 ⁽¹²⁾
γ ¹	50° min.	—	—
γ ²	40° min.	—	—

Cap: H9: PGJ19-5 in accordance with IEC Publication 60061 (sheet 7004-110-2)
H9B: PGJY19-5 in accordance with IEC Publication 60061 (sheet 7004-146-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	65	65
Test voltage	Volts	13,2	13,2
Objective values	Watts	73 max.	73 max.
	Luminous flux	2 100 ± 10 %	
Reference luminous flux at approximately		12 V	1 500
		13,2 V	2 100

⁽⁹⁾ The viewing direction is direction A as shown in Figure 1 on sheet H9/1.

⁽¹⁰⁾ The ends of the filament are defined as the points where, when the viewing direction is as defined in note 9 above, the projection of the outside of the end turns crosses the filament axis.

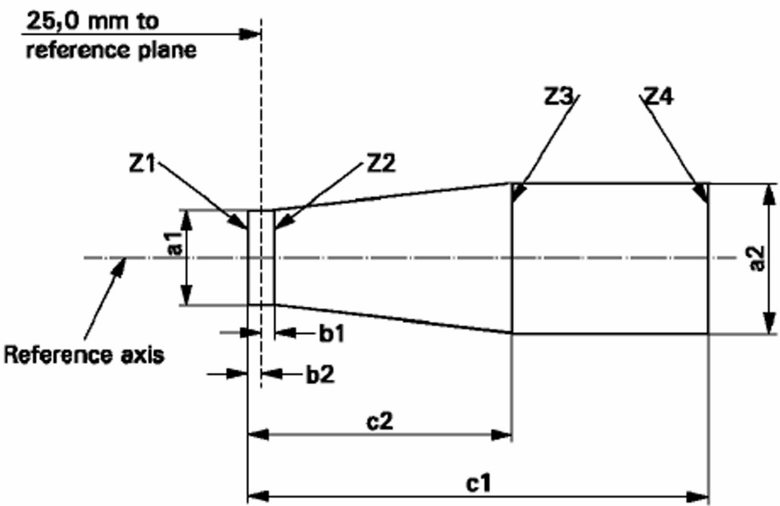
⁽¹¹⁾ To be checked by means of a 'Box System'; sheet H9/4.

⁽¹²⁾ The eccentricity is measured only in viewing directions A and B as shown in Figure 1 on sheet H9/1. The points to be measured are those where the projection of the outside of the end turns nearest or furthest from the reference plane crosses the filament axis.

CATEGORIES H9 AND H9B — Sheet H9/4

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament complies with the requirements.



a1	a2	b1	b2	c1	c2
d + 0,4	d + 0,7	0,25		5,7	4,6

d = diameter of filament

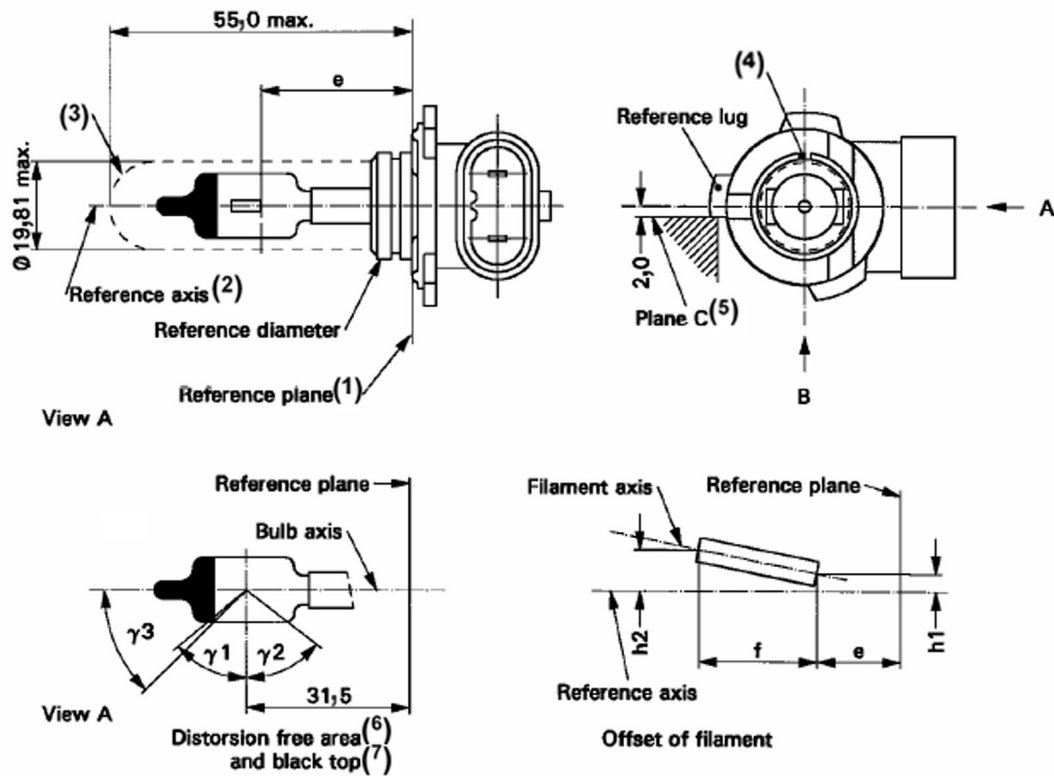
The filament position is checked solely in directions A and B as shown on sheet H9/1, Figure 1.

The filament shall lie entirely within the limits shown.

The ends of the filament as defined on sheet H9/3, note 10, shall lie between lines Z1 and Z2 and between Z3 and Z4.

CATEGORY H10 — Sheet H10/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



(1) The reference plane is the plane defined by the meeting points of cap-holder fit.

(2) The reference axis is perpendicular to the reference plane and concentric with the reference diameter of the cap.

(3) Glass bulb and supports shall not exceed the envelope and shall not interfere with insertion past the lamp key. The envelope is concentric to the reference axis.

(4) The keyway is mandatory.

(5) The filament lamp shall be rotated in the measuring holder until the reference lug contacts plane C of the holder.

(6) Glass bulb periphery shall be optically distortion-free axially and cylindrically within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 and does not need to be verified in the area covered by the obscuration.

(7) The obscuration shall extend to at least angle γ_3 and shall be at least as far as the undistorted part of the bulb defined by angle γ_1 .

CATEGORY H10 — Sheet H10/2

Dimensions in mm ⁽⁸⁾		Tolerance	
		Filament lamps of normal production	Standard filament lamp
e ⁽⁹⁾ ⁽¹⁰⁾	28,9	⁽¹¹⁾	± 0,16
f ⁽¹²⁾ ⁽¹³⁾	5,2	⁽¹¹⁾	± 0,16
h1, h2	0	⁽¹¹⁾	± 0,15 ⁽¹²⁾
γ ¹	50° min.	—	—
γ ²	52° min.	—	—
γ ³	45°	± 5°	± 5°

Cap PY20d in accordance with IEC Publication 60061 (sheet 7004-31-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	42	42
Test voltage	Volts	13,2	13,2
Objective values	Watts	50 max.	50 max.
	Luminous flux	850 ± 15 %	
Reference luminous flux at approximately		12 V	600
		13,2 V	850

⁽⁸⁾ Dimensions shall be checked with O-ring removed.

⁽⁹⁾ The viewing direction is direction (*)/B as shown in the figure on sheet H10/1.

⁽¹⁰⁾ The ends of the filament are defined as the points where, when the viewing direction (*) as defined in note 9 above, the projection of the outside of the end turns crosses the filament axis.

⁽¹¹⁾ To be checked by means of a 'Box-System', sheet H10/3 (*).

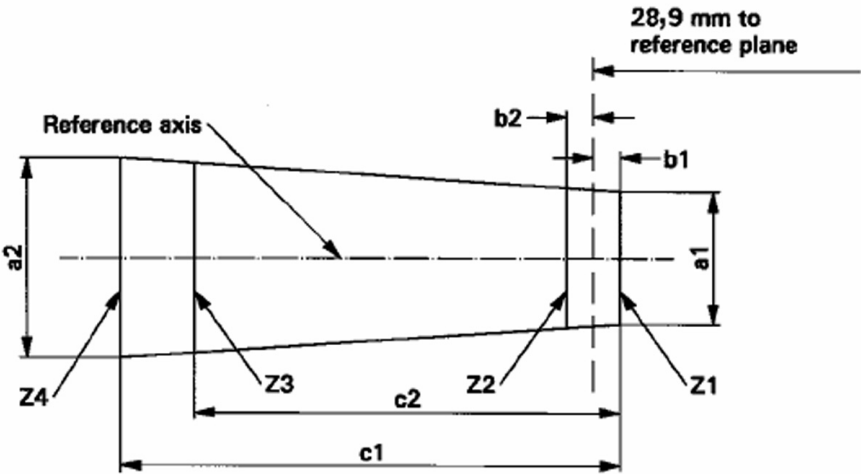
⁽¹²⁾ The eccentricity is measured only in viewing directions (*) A and B as shown in the figure on sheet H10/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

(*) Manufacturers may choose another set of perpendicular viewing directions. The viewing directions specified by the manufacturer are to be used by the testing laboratory when checking filament dimensions and position.

CATEGORY H10 — Sheet H10/3

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



	a1	a2	b1	b2	c1	c2
12 V	1,4 d	1,8 d	0,25		6,1	4,9

d = diameter of filament.

The filament position is checked solely in directions A and B as shown on sheet H10/1.

The filament shall lie entirely within the limits shown.

The ends of the filament as defined on sheet H10/2 note 10 shall lie between lines Z1 and Z2 and between lines Z3 and Z4.

CATEGORIES H11 AND H11B — Sheet H11/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

Figure 1

Main drawings

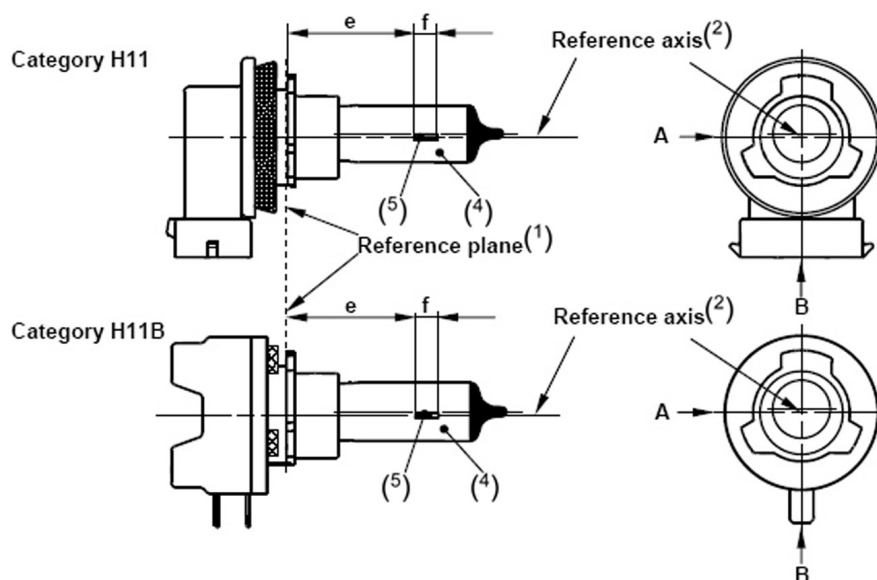
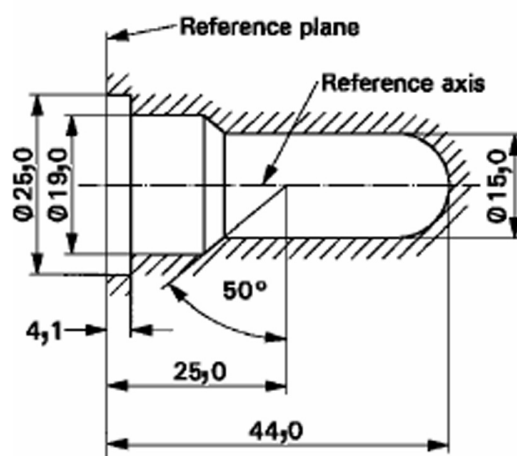


Figure 2

Maximum lamp outline ⁽³⁾

⁽¹⁾ The reference plane is the plane formed by the underside of the bevelled lead-in flange of the cap.

⁽²⁾ The reference axis is perpendicular to the reference plane and passing through the centre of the 19 mm cap diameter.

⁽³⁾ Glass bulb and supports shall not exceed the envelope as indicated in Figure 2. The envelope is concentric to the reference axis.

⁽⁴⁾ The colour of the light emitted shall be white or selective-yellow.

⁽⁵⁾ Notes concerning the filament diameter:

(a) No actual diameter restrictions apply but the objective for future developments is to have $d_{\max} = 1,4$ mm.

(b) For the same manufacturer, the design diameter of standard (étalon) filament lamp and filament lamp of normal production shall be the same.

CATEGORIES H11 AND H11B — Sheet H11/2

Figure 3

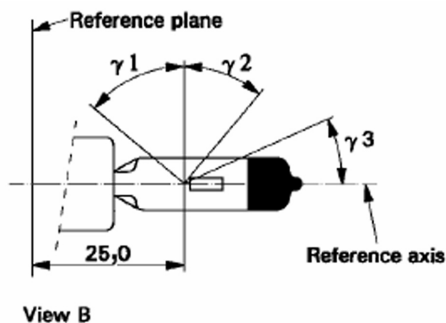
Distortion free area ⁽⁶⁾ and black top ⁽⁷⁾

Figure 4

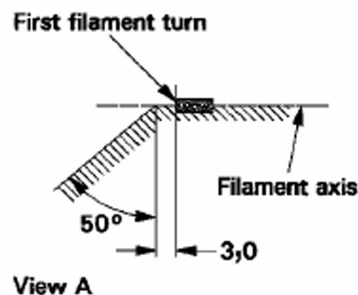
Metal free zone ⁽⁸⁾

Figure 5

Permissible offset of filament axis ⁽⁹⁾

(for standard filament lamps only)

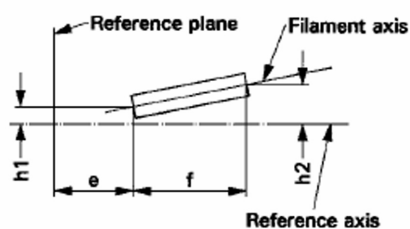
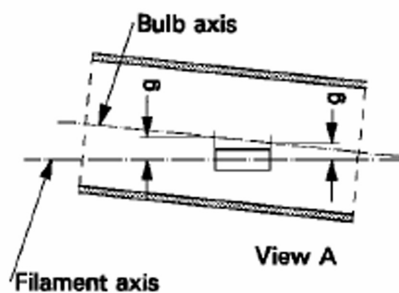


Figure 6

Bulb eccentricity ⁽¹⁰⁾

- ⁽⁶⁾ Glass bulb shall be optically distortion free within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 .
- ⁽⁷⁾ The obscuration shall extend at least to the cylindrical part of the bulb on the whole bulb top circumference. It shall, moreover, extend at least to a plane parallel to the reference plane where γ_3 crosses the outer bulb surface (view B as indicated on sheet H11/1).
- ⁽⁸⁾ The internal design of the lamp shall be such that stray light images and reflections are only located above the filament itself seen from the horizontal direction (view A as indicated in Figure 1 on sheet H11/1). No metal parts other than filament turns shall be located in the shaded area as seen in Figure 4.
- ⁽⁹⁾ The offset of the filament with respect to the reference axis is measured only in viewing directions A and B as shown in Figure 1 on sheet H11/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.
- ⁽¹⁰⁾ Eccentricity of bulb axis with respect to filament axis measured in two planes parallel to the reference plane where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

CATEGORIES H11 AND H11B — Sheet H11/3

Dimensions in mm	Filaments lamps of normal production		Standard filament lamp
	12 V	24 V	12 V
e ⁽¹⁾	25,0 ⁽¹²⁾		25,0 ± 0,1
f ⁽¹³⁾	4,5	5,3 ⁽¹⁴⁾	4,5 ± 0,1
g	0,5 min.		under consideration
h1	0 ⁽¹⁵⁾		0 ± 0,1
h2	0 ⁽¹⁶⁾		0 ± 0,15
γ1	50° min.		50° min.
γ2	40° min.		40° min.
γ3	30° min.		30° min.

Cap: H11: PGJ19-2 in accordance with IEC Publication 60061 (sheet 7004-110-2)
H11B: PGJY19-2 in accordance with IEC Publication 60061 (sheet 7004-146-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	24	12
	Watts	55	70	55
Test voltage	Volts	13,2	28,0	13,2
Objective values	Watts	62 max.	80 max.	62 max.
	Luminous flux	1 350 ± 10 %	1 600 ± 10 %	
Reference luminous flux at approximately			12 V	1 000
			13,2 V	1 350

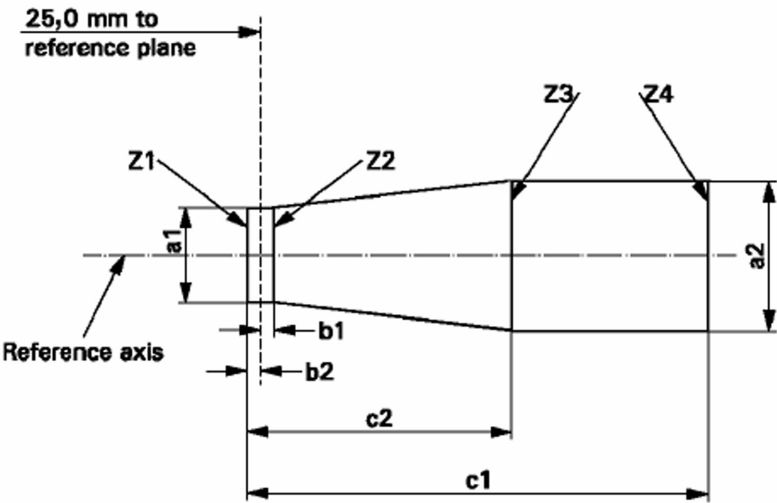
⁽¹⁾ The ends of the filament are defined as the points where, when the viewing direction is View A as shown in Figure 1 on sheet H11/1, the projection of the outside of the end turns crosses the filament axis.

⁽¹²⁾ To be checked by means of a 'Box System'; sheet H11/4.

CATEGORIES H11 AND H11B — Sheet H11/4

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament complies with the requirements.



	a1	a2	b1	b2	c1	c2
12 V	d + 0,3	d + 0,5	0,2		5,0	4,0
24 V	d + 0,6	d + 1,0	0,25		6,3	4,6

d = diameter of filament

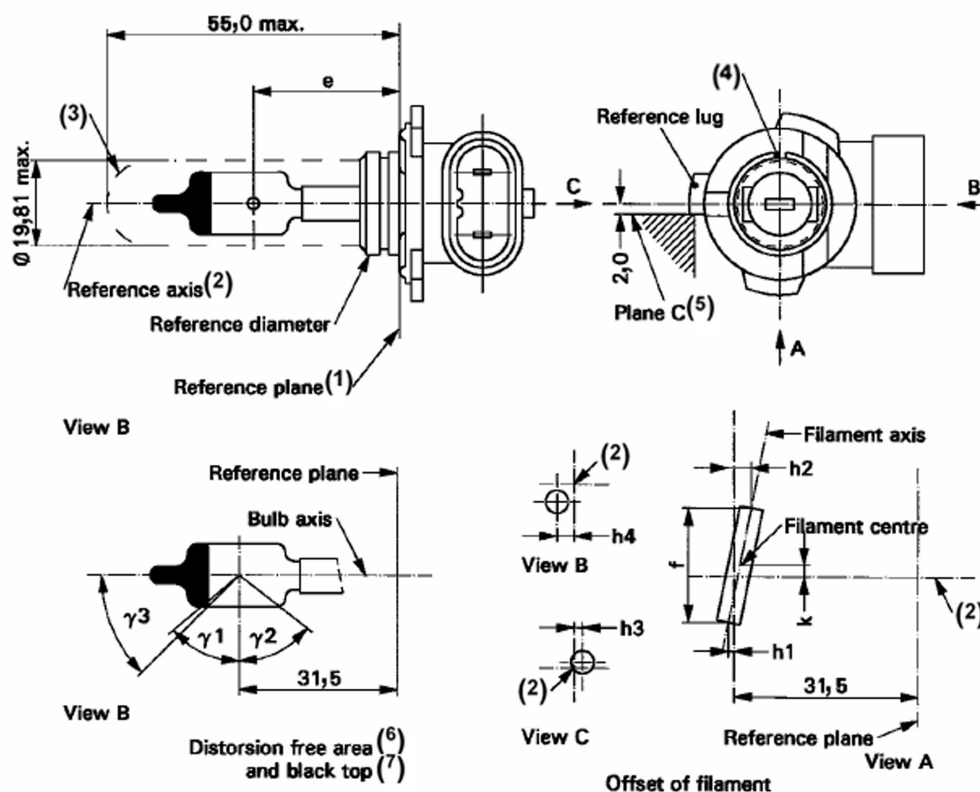
The filament position is checked solely in directions A and B as shown on sheet H11/1, Figure 1.

The filament shall lie entirely within the limits shown.

The ends of the filament as defined on sheet H11/3, note 11, shall lie between lines Z1 and Z2 and between Z3 and Z4.

CATEGORY H12 — Sheet H12/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



(1) The reference plane is the plane defined by the meeting points of cap-holder fit.

(2) The reference axis is perpendicular to the reference plane and concentric with the reference diameter of the cap.

(3) Glass bulb and supports shall not exceed the envelope and shall not interfere with insertion past the lamp key. The envelope is concentric to the reference axis.

(4) The keyway is mandatory.

(5) The filament shall be rotated in the measuring holder until the reference lug contacts plane C of the holder.

(6) Glass bulb periphery shall be optically distortion-free axially and cylindrically within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 and does not need to be verified in the area covered by the obscuration.

(7) The obscuration shall extend to at least angle γ_3 and shall be at least as far as the undistorted part of the bulb defined by angle γ_1 .

CATEGORY H12 — Sheet H12/2

Dimensions in mm ⁽⁸⁾		Tolerance	
		Filament lamps of normal production	Standard filament lamp
e ⁽⁹⁾ ⁽¹⁰⁾	31,5	⁽¹¹⁾	± 0,16
f ⁽⁹⁾ ⁽¹⁰⁾	5,5	4,8 min	± 0,16
h1, h2, h3, h4	0	⁽¹¹⁾	± 0,15 ⁽¹²⁾
k	0	⁽¹¹⁾	± 0,15 ⁽¹³⁾
γ1	50° min.	—	—
γ2	52° min.	—	—
γ3	45°	± 5°	± 5°

Cap PZ20d in accordance with IEC Publication 60061 (sheet 7004-31-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

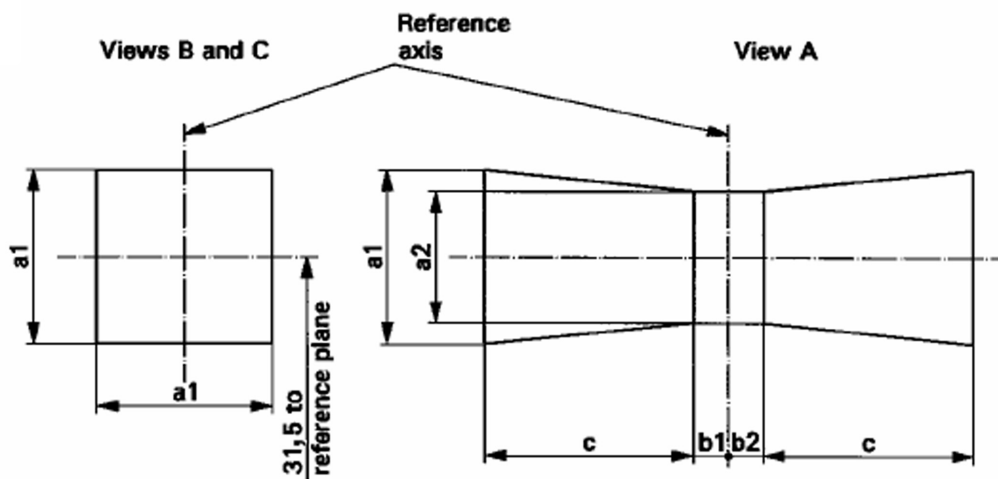
Rated values	Volts	12	12
	Watts	53	53
Test voltage	Volts	13,2	13,2
Objective values	Watts	61 max.	61 max.
	Luminous flux	1 050 ± 15 %	
Reference luminous flux at approximately		12 V	775
		13,2 V	1 050

⁽⁸⁾ Dimensions shall be checked with O-ring removed.⁽⁹⁾ The viewing direction is direction A as shown in the figure on sheet H12/1.⁽¹⁰⁾ The ends of the filament are defined as the points where, when the viewing direction as defined in note 9 above, the projection of the outside of the end turns crosses the filament axis.⁽¹¹⁾ To be checked by means of a 'Box-System'; sheet H12/3.⁽¹²⁾ Dimensions h1 and h2 are measured in viewing direction A, dimension h3 in direction C and dimension h4 in direction B as shown in the figure on sheet H12/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.⁽¹³⁾ Dimension k is measured only in viewing direction A.

CATEGORY H12 — Sheet H12/3

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



a1	a2	b1	b2	c
1,6 d	1,3 d	0,30	0,30	2,8

d = diameter of filament

For the directions of view A, B and C, see sheet H12/1.

The filament shall lie entirely within the limits shown.

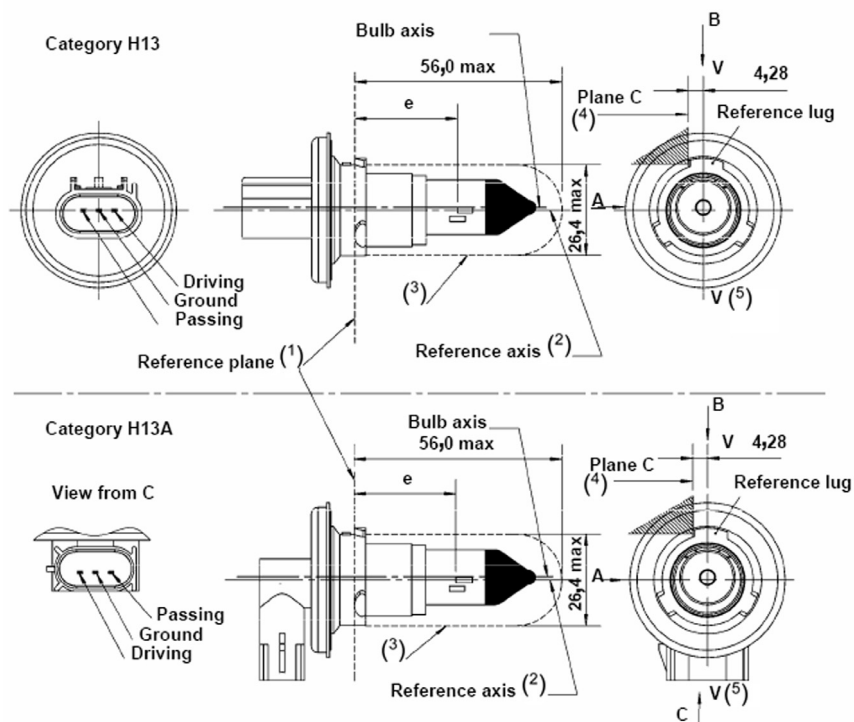
The centre the filament shall lie between the limits of dimensions b1 and b2.

CATEGORIES H13 AND H13A — Sheet H13/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

Figure 1

Main drawing



⁽¹⁾ The reference plane is the plane formed by the underside of the three radiused tabs of the cap.

⁽²⁾ The reference axis is perpendicular to the reference plane and crosses the intersection of the two perpendiculars as indicated in Figure 2 on sheet H13/2.

⁽³⁾ Glass bulb and supports shall not exceed the envelope as indicated. The envelope is concentric to the reference axis.

⁽⁴⁾ The filament lamp shall be rotated in the measuring holder until the reference lug contacts plane C of the holder.

⁽⁵⁾ Plane V-V is the plane perpendicular to the reference plane passing through the reference axis and parallel to plane C.

CATEGORIES H13 AND H13A — Sheet H13/2

Figure 2

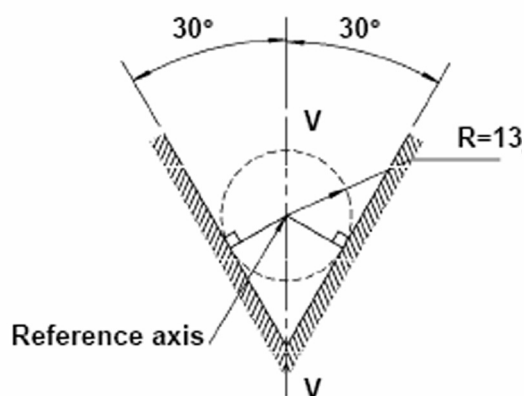
Definition of reference axis ⁽²⁾

Figure 4

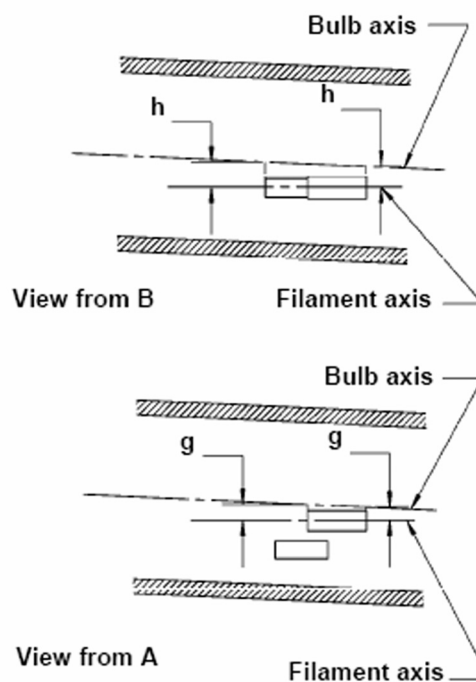
Bulb offset ⁽⁸⁾

Figure 3

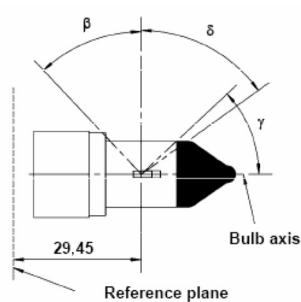
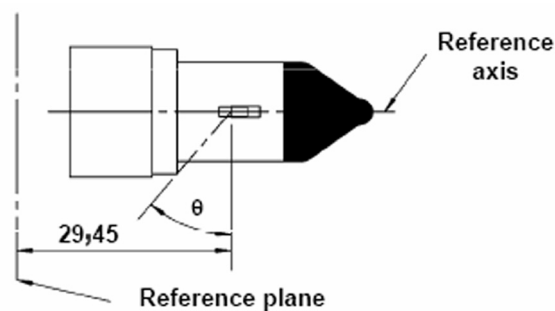
Undistorted area ⁽⁶⁾ and opaque coating ⁽⁷⁾

Figure 5

Light blocking toward cap ⁽⁹⁾

⁽⁶⁾ Glass bulb shall be optically distortion-free axially and cylindrically within the angles β and δ . This requirement applies to the whole bulb circumference within the angles β and δ and does not need to be verified in the area covered by the opaque coating.

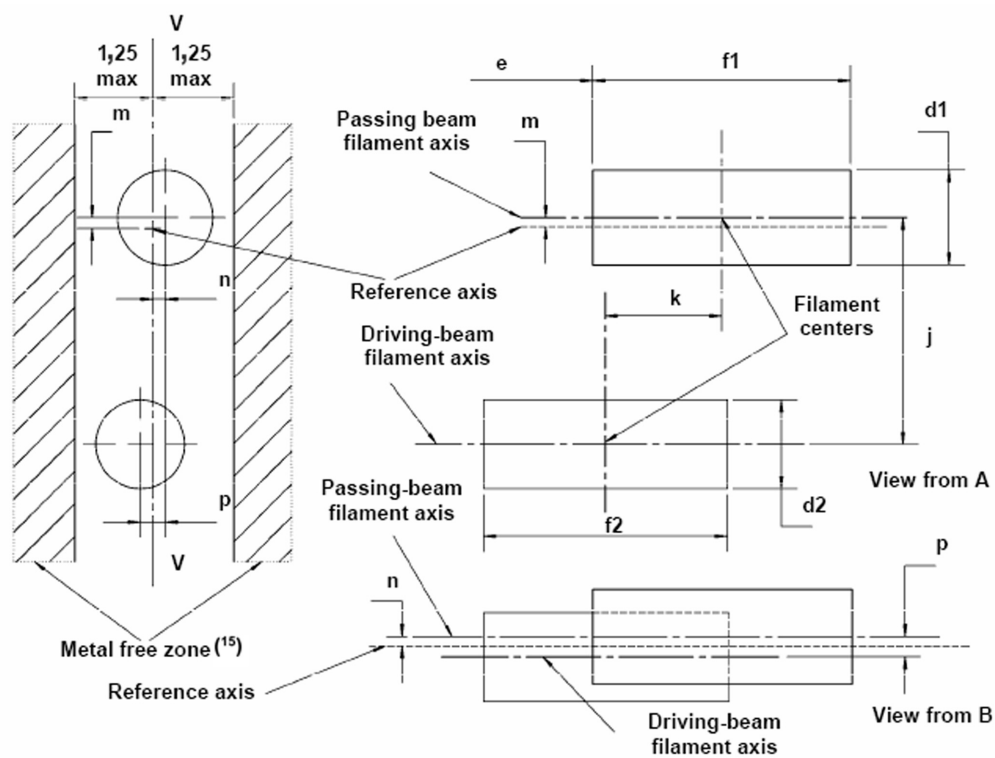
⁽⁷⁾ The opaque coating shall extend at least to the cylindrical part of the bulb on the whole bulb top circumference. It shall moreover extend at least to a plane parallel to the reference plane where γ crosses the outer bulb surface (view B as indicated on sheet H13/1).

⁽⁸⁾ Offset of passing-beam filament in relation to the bulb axis is measured in two planes parallel to the reference plane where the projection of the outside end turns nearest to and farthest from the reference plane crosses the passing-beam filament axis.

⁽⁹⁾ Light shall be blocked over the cap end of the bulb extending to angle ϑ . This requirement applies in all directions around the reference axis.

CATEGORIES H13 AND H13A — Sheet H13/3

Figure 6

Position and dimensions of filaments ⁽¹⁰⁾ ⁽¹¹⁾ ⁽¹²⁾ ⁽¹³⁾ ⁽¹⁴⁾

⁽¹⁰⁾ Dimensions j, k and p are measured from the centre of the passing-beam filament to the centre of the driving-beam filament.

⁽¹¹⁾ Dimensions m and n are measured from the reference axis to the centre of the passing-beam filament.

⁽¹²⁾ Both filaments axis are to be held within a 2° tilt with respect to the reference axis about the centre of the respective filament.

⁽¹³⁾ Note concerning the filament diameters.

(a) For the same manufacturer, the design filament diameter of standard (étalon) filament lamp and filament lamp of normal production shall be the same.

⁽¹⁴⁾ For both the driving-beam and the passing-beam filament distortion shall not exceed ± 5 per cent of filament diameter from a cylinder.

⁽¹⁵⁾ The metal free zone limits the location of lead wires within the optical path. No metal parts shall be located in the shaded area as seen in Figure 6.

CATEGORIES H13 AND H13A — Sheet H13/4

Dimensions in mm		Tolerance	
		Filaments lamps of normal production	Standard filament lamp
d1 ⁽¹³⁾ ⁽¹⁷⁾	1,8 max.	—	—
d2 ⁽¹³⁾ ⁽¹⁷⁾	1,8 max.	—	—
e ⁽¹⁶⁾	29,45	± 0,20	± 0,10
f1 ⁽¹⁶⁾	4,6	± 0,50	± 0,25
f2 ⁽¹⁶⁾	4,6	± 0,50	± 0,25
g ⁽⁸⁾ ⁽¹⁷⁾	0,5 d1	± 0,40	± 0,20
h ⁽⁸⁾	0	± 0,30	± 0,15
j ⁽¹⁰⁾	2,5	± 0,20	± 0,10
k ⁽¹⁰⁾	2,0	± 0,20	± 0,10
m ⁽¹¹⁾	0	± 0,20	± 0,13
n ⁽¹¹⁾	0	± 0,20	± 0,13
p ⁽¹⁰⁾	0	± 0,08	± 0,08
β	42° min.	—	—
δ	52° min.	—	—
γ	43°	+ 0° / - 5°	+ 0° / - 5°
θ ⁽⁹⁾	41°	± 4°	± 4°

Cap: H13: P26.4t in accordance with IEC Publication 60061 (sheet 7004-128-3)
H13A: PJ26.4t

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS ⁽¹⁸⁾

Rated values	Volts	12		12	
	Watts	55	60	55	60
Test voltage	Volts	13,2		13,2	
Objective values	Watts	68 max.	75 max.	68 max.	75 max.
	Luminous flux	1 100 ± 15 %	1 700 ± 15 %		
Reference luminous flux at approximately			12 V	800	1 200
			13,2 V	1 100	1 700

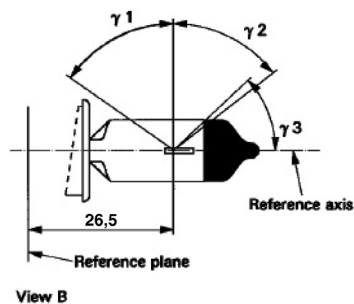
⁽¹⁶⁾ The ends of the filament are defined as the points where, when the viewing direction is direction A as shown on sheet H13/1, the projection of the outside of the end turns crosses the filament axis.

⁽¹⁷⁾ d1 is the actual diameter of the passing-beam filament. d2 is the actual diameter of the driving-beam filament.

⁽¹⁸⁾ The values indicated in the left-hand columns relate to the passing-beam filament and those indicated in the right-hand columns to the driving-beam filament.

CATEGORY H14 — Sheet H14/2

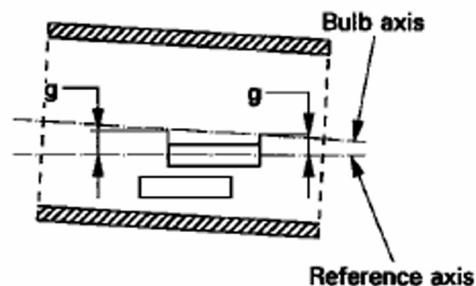
Figure 3

Distortion free area ⁽⁴⁾ and black top ⁽⁵⁾

View B

Figure 4

Bulb eccentricity

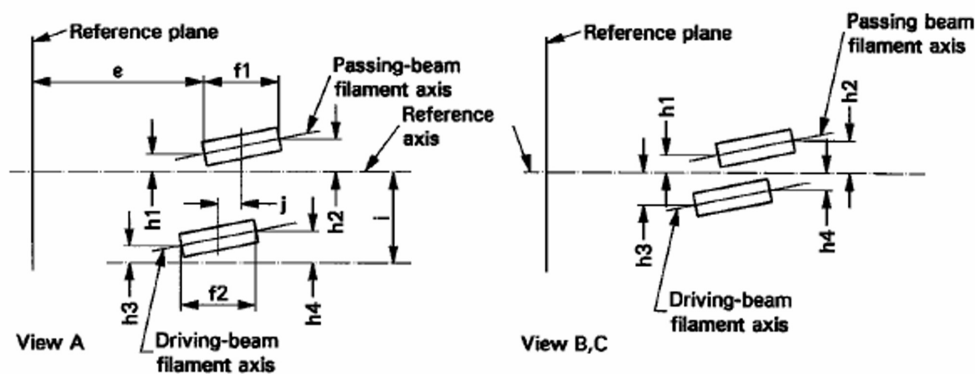


View A

Figure 5

Offset of filament axis ⁽⁷⁾

(for standard filament lamps only)



- ⁽⁴⁾ Glass bulb shall be optically distortion free within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 and does not need to be verified in the area covered by the obscuration.
- ⁽⁵⁾ The obscuration shall extend at least to the cylindrical part of the bulb on the whole bulb top circumference. It shall, moreover, extend at least to a plane parallel to the reference plane where γ_3 crosses the outer bulb surface (view B as indicated on sheet H14/1).
- ⁽⁶⁾ Eccentricity of bulb with respect to passing-beam filament axis is measured in two planes parallel to the reference plane where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the passing-beam filament axis.
- ⁽⁷⁾ The offset of the filaments with respect to the reference axis is measured only in viewing direction A, B and C as shown in Figure 1 on sheet H14/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filaments axis.

CATEGORY H14 — Sheet H14/3

Dimensions in mm		Filament lamp of normal production	Standard filament lamps
e ⁽⁸⁾	26,15	⁽¹⁰⁾	± 0,1
f1 ⁽⁸⁾ ⁽⁹⁾	5,3	⁽¹⁰⁾	± 0,1
f2 ⁽⁸⁾ ⁽⁹⁾	5,0	⁽¹⁰⁾	± 0,1
g	0,3 min.		
h1	0	⁽¹⁰⁾	± 0,1
h2	0	⁽¹⁰⁾	± 0,15
h3	0	⁽¹⁰⁾	± 0,15
h4	0	⁽¹⁰⁾	± 0,15
i	2,7		—
j	2,5	⁽¹⁰⁾	± 0,1
γ ¹	55° min.	—	—
γ ²	52° min.	—	—
γ ³	43°	0 / - 5°	0 / - 5°

Cap P38t in accordance with IEC Publication 60061 (sheet 7004-133-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12		12	
	Watts	55	60	55	60
Test voltage	Volts	13,2		13,2	
Objective values	Watts	68 max.	75 max.	68 max.	75 max.
	Luminous flux	1 150 ± 15 %	1 750 ± 15 %		
Reference luminous flux at approximately			12 V	860	1 300
			13,2 V	1 150	1 750

⁽⁸⁾ The ends of the filaments are defined as the points where, when the viewing direction is direction A as shown in Figure 1 on sheet H14/1, the projection of the outside of the end turns crosses the filaments axis.

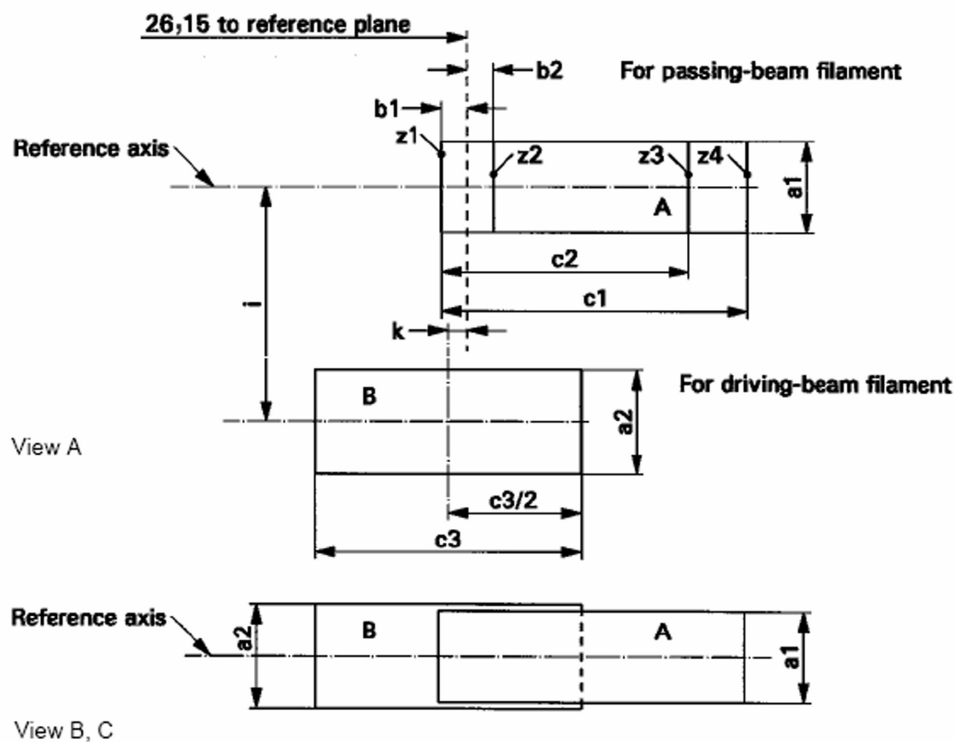
⁽⁹⁾ 'f1' represents the length of the passing-beam filament and 'f2' represents the length of the driving-beam filament.

⁽¹⁰⁾ To be checked by means of a 'Box system'; sheet H14/4.

CATEGORY H14 — Sheet H14/4

Screen projection requirements

This test is used to determine, by checking whether the filaments are correctly positioned relative to the reference axis and the reference plane, whether a filament lamp complies with the requirements.



a1	a2	b1	b2	c1	c2	c3	i	k
$d1 + 0,5$	$1,6 * d2$	0,2		5,8	5,1	5,75	2,7	0,15

$d1$ is diameter of the passing beam filament and $d2$ that of the driving beam filament.

Notes concerning the filaments diameter:

- (a) No actual diameter restrictions apply but the objective for future developments is to have $d1 \text{ max.} = 1,6 \text{ mm}$ and $d2 \text{ max.} = 1,6 \text{ mm}$.
 - (b) For the same manufacture, the design diameter of standard filament lamps and filament lamps of normal production shall be the same.
- The positions of the filaments are checked solely in directions A, B and C as shown in Figure 1 on sheet H14/1.
 The passing-beam filament shall lie entirely in the rectangle A and the driving beam filament entirely in rectangle B.
 The ends of the passing-beam filament as defined on sheet H14/3, note 8 shall lie between lines Z1 and Z2 and between lines Z3 and Z4.

CATEGORY H15 — Sheet H15/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

Figure 1

Main drawing

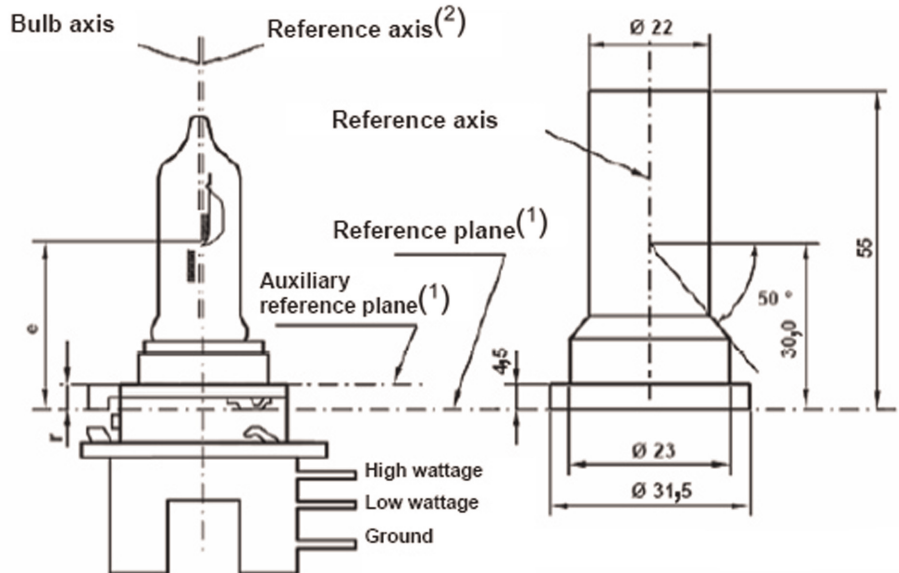


Figure 3

Maximum lamp outlines ⁽³⁾

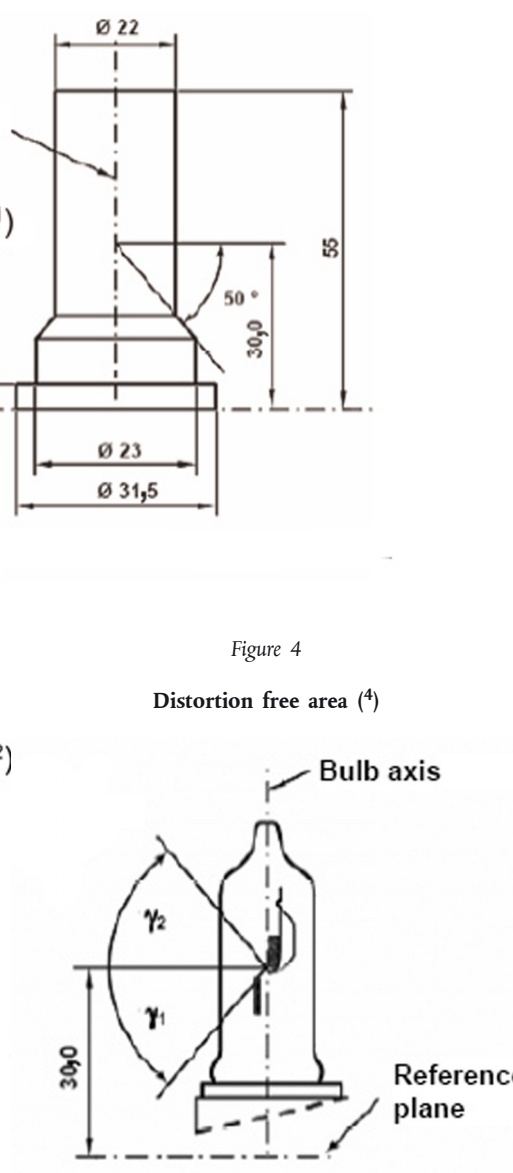


Figure 2

Definition of reference axis ⁽²⁾

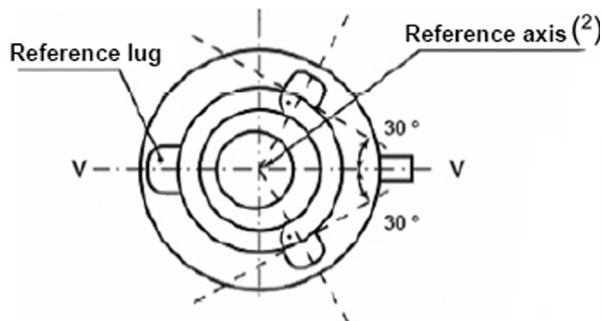
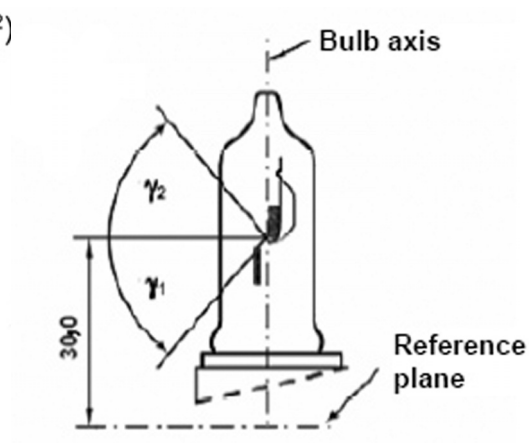


Figure 4

Distortion free area ⁽⁴⁾

⁽¹⁾ The reference plane is defined by the points at which the holder touches the three lugs of the cap ring from the plug side. It is intended for use as an internal reference plane.

The auxiliary reference plane is defined by the points on the surface of the holder on which the three supporting bosses of the cap ring will rest. It is intended for use as an external reference plane.

The Cap is designed for use of the (internal) reference plane, but for certain applications the (external) auxiliary reference plane may be used instead.

(2) The reference axis is perpendicular to the reference plane and crosses the intersection of the two perpendiculars as indicated in figure 2 on sheet H15/1.

(3) Glass bulb and supports shall not exceed the envelope as indicated in figure 3. The envelope is concentric to the reference axis.

(4) Glass bulb shall be optically distortion free within the angles γ_1 and γ_2 as indicated in figure 4. This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 .

CATEGORY H15 — Sheet H15/2

Dimensions in mm	Filament lamps of normal production		Standard filament lamp
	12 V	24 V	12 V
e	30,0 + 0,35 / - 0,25	30,0 + 0,35 / - 0,25	30,0 + 0,20 / - 0,15
Y ₁	50° min	50° min	50° min
Y ₂	50° min	50° min	50° min
r	For details see cap sheet		

Cap PGJ23t-1 in accordance with IEC Publication 60061 (sheet 7004-155-1)

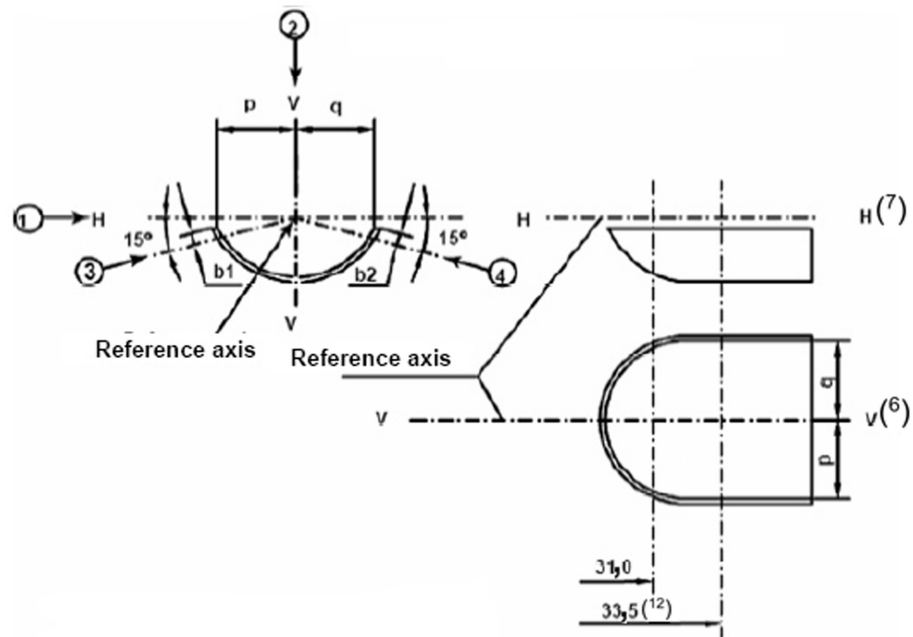
ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12 (5)		24 (5)		12 (5)	
	Watts	15	55	20	60	15	55
Test voltage	Volts	13,2		28,0		13,2	13,2
Objective values	Watts	19 max.	64 max.	24 max.	73 max.	19 max.	64 max.
	Luminous flux	260	1 350	300	1 500		
		± 10 %					
Reference luminous flux at approximately 12 V							1 000
Reference luminous flux at approximately 13,2 V							1 350
Reference luminous flux at approximately 13,5 V						290	

⁽⁵⁾ The values indicated in the left-hand columns relate to the low wattage filament. Those indicated in the right-hand columns relate to the high wattage filament.

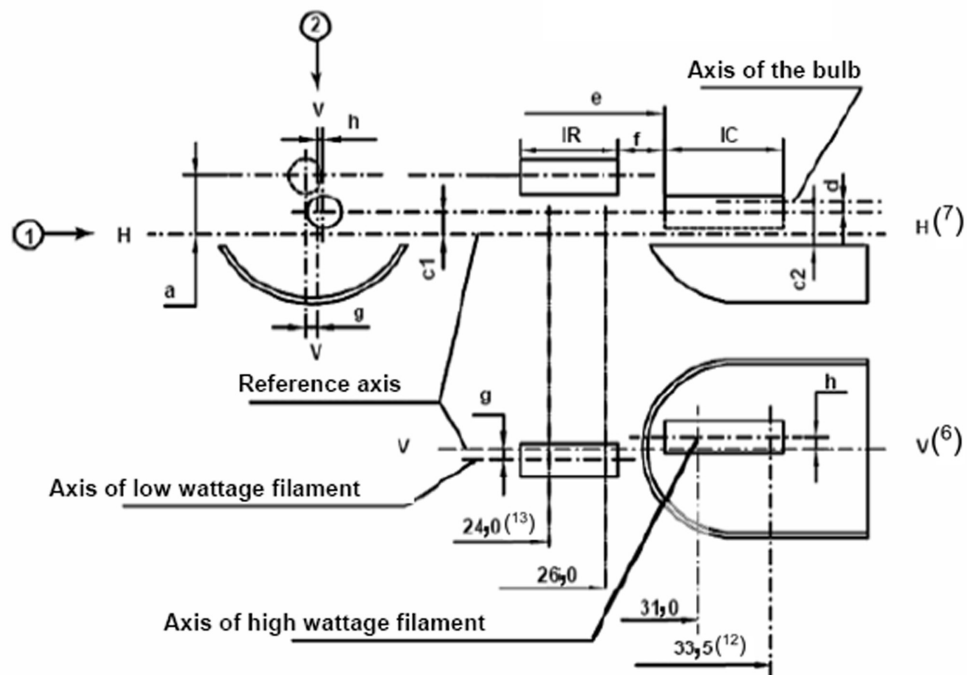
CATEGORY H15 — Sheet H15/3

Position of the shield



The drawing is not mandatory with respect to the design of the shield

Position of the filaments



CATEGORY H15 — Sheet H15/4

Table of the dimensions (in mm) referred to in the drawings on sheet H15/3

Reference (*)		Dimension (**)		Tolerance			
				Filament lamps of normal production		Standard filament lamp	
12 V	24 V	12 V	24 V	12 V	24 V	12 V	24 V
a/24,0	a/24,5	1,8		± 0,35		± 0,20	
a/26,0		1,8		± 0,35		± 0,20	
b1/31,0		0		± 0,30		± 0,15	
b1/33,5	b1/34,0	b1/31,0 mv		± 0,30		± 0,15	
b2/31,0		0		± 0,30		± 0,15	
b2/33,5	b2/34,0	b2/31,0 mv		± 0,30		± 0,15	
c1/31,0		0		± 0,30	± 0,50	± 0,15	± 0,25
c1/33,5	c1/34,0	c1/31,0 mv		± 0,30	± 0,50	± 0,15	± 0,25
c2/33,5	c2/34,0	1,1		± 0,30	± 0,50	± 0,15	± 0,25
d		min. 0,1		—		—	
f ⁽⁸⁾ ⁽⁹⁾ ⁽¹⁰⁾		2,7		± 0,30	± 0,40	+ 0,20 – 0,10	+ 0,25 – 0,15
g/24,0	g/24,5	0		± 0,50	± 0,70	± 0,25	± 0,35
g/26,0		0		± 0,50	± 0,70	± 0,25	± 0,35
h/31,0		0		± 0,50	± 0,60	± 0,25	± 0,30
h/33,5	h/34,0	h/31,0 mv		± 0,30	± 0,40	± 0,15	± 0,20
l _R ⁽⁸⁾ ⁽¹¹⁾		4,2	4,6	± 0,40	± 0,60	± 0,20	± 0,30
l _C ⁽⁸⁾ ⁽⁹⁾		4,4	5,4	± 0,40	± 0,60	± 0,20	± 0,30
p/33,5	p/34,0	Depends on the shape of the shield		—		—	
q/33,5	q/34,0	p/33,5	p/34,0	± 1,20		± 0,60	

(*) '.../26,0' means dimension to be measured at the distance from the reference plane indicated in mm after the stroke.

(**) '31,0 mv' means the value measured at a distance of 31,0 mm from the reference plane.

⁽⁹⁾ Plane V-V is the plane perpendicular to the reference plane and passing through the reference axis and through the axis of the reference lug.

⁽⁷⁾ Plane H-H is the plane perpendicular to the reference plane and plane V-V passing through the reference axis.

⁽⁸⁾ The end turns of the filament are defined as being the first luminous turn and the last luminous turn that are at substantially the correct helix angle.

⁽⁹⁾ For the high wattage filament, the points to be measured are the intersections, seen in direction 1, of the lateral edge of the shield with the outside of the end turns defined under footnote 8.

⁽¹⁰⁾ 'e' denotes the distance from the reference plane to the beginning of the driving beam filament as defined above.

⁽¹¹⁾ For the low wattage filament the points to be measured are the intersections, seen in direction 1, of a plane, parallel to plane H-H and situated at a distance of 1,8 mm above it, with the end turns defined under footnote 8.

⁽¹²⁾ 34,0 for the 24 V type.

⁽¹³⁾ 24,5 for the 24 V type.

CATEGORY H15 — Sheet H15/5*Additional explanations to sheet H15/3*

The dimensions below are measured in four directions:

(1) for dimensions a, c1, c2, d, e, f, lR and lC;

(2) for dimensions g, h, p and q;

(3) for dimension b1;

(4) for dimension b2.

Dimensions b1, b2, c1 and h are measured in planes parallel to the reference plane at distances of 31,0 mm and 33,5 mm (34,0 mm for 24 V types).

Dimensions c2, p and q are measured in a plane parallel to the reference plane at a distance of 33,5 mm (34,0 mm for 24 V types).

Dimensions a and g are measured in planes parallel to the reference plane at distances of 24,0 mm (24,5 mm for 24 V types) and 26,0 mm.

CATEGORY H16 — Sheet H16/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

CATEGORY H16

Figure 1

Main drawing

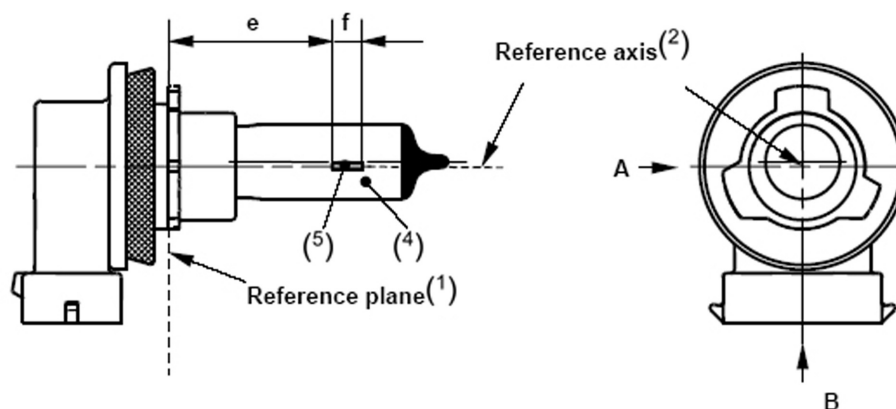
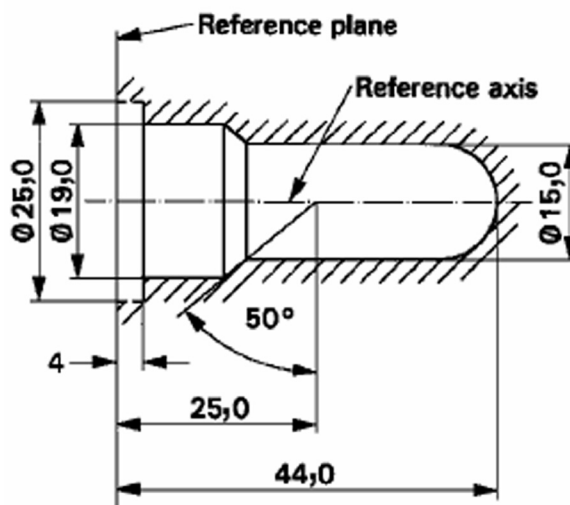


Figure 2

Maximum lamp outline ⁽³⁾

⁽¹⁾ The reference plane is the plane formed by the underside of the bevelled lead-in flange of the cap.

⁽²⁾ The reference axis is perpendicular to the reference plane and passing through the centre of the 19 mm cap diameter.

⁽³⁾ Glass bulb and supports shall not exceed the envelope as indicated in Figure 2. The envelope is concentric to the reference axis.

⁽⁴⁾ The light emitted shall be white or selective yellow.

⁽⁵⁾ Notes concerning the filament diameter:

— No actual diameter restrictions apply but the objective for future developments is to have $d_{\max.} = 0,9$ mm.

— For the same manufacturer, the design diameter of standard (étalon) filament lamp and filament lamp of normal production shall be the same.

CATEGORY H16 — Sheet H16/2

Figure 3

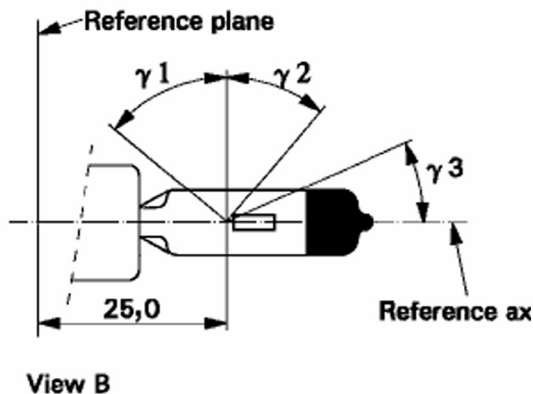
Distortion free area ⁽⁶⁾ and black top ⁽⁷⁾

Figure 4

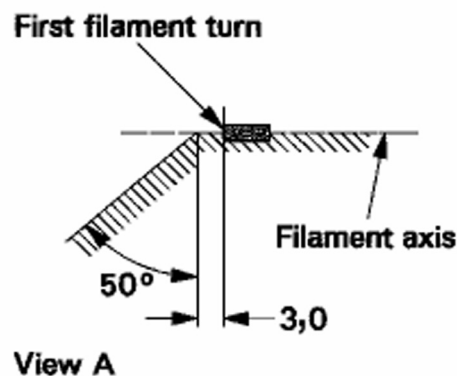
Metal free zone ⁽⁸⁾

Figure 5

Permissible offset of filament axis ⁽⁹⁾

(for standard filament lamps only)

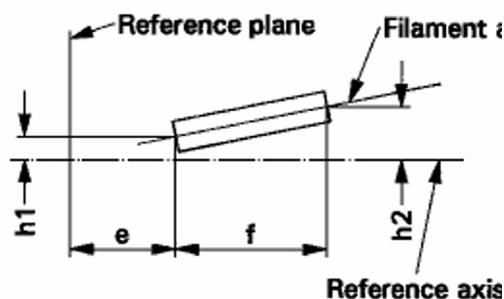
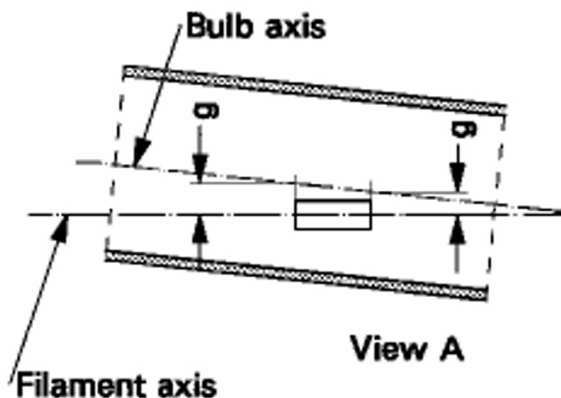


Figure 6

Bulb eccentricity ⁽¹⁰⁾

- ⁽⁶⁾ Glass bulb shall be optically distortion free within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 .
- ⁽⁷⁾ The obscuration shall extend at least to angle γ_3 and shall extend at least to the cylindrical part of the bulb on the whole bulb top circumference.
- ⁽⁸⁾ The internal design of the lamp shall be such that stray light images and reflections are only located above the filament itself seen from the horizontal direction. (View A as indicated in Figure 1 on sheet H16/1). No metal parts other than filament turns shall be located in the shaded area as seen in Figure 4.
- ⁽⁹⁾ The offset of the filament with respect to the reference axis is measured only in viewing directions A and B as shown in Figure 1 in sheet H16/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.
- ⁽¹⁰⁾ Offset of filament in relation to bulb axis measured in two planes parallel to the reference plane where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

CATEGORY H16 — Sheet H16/3

Dimensions in mm	Filaments lamps of normal production	Standard filament lamp
	12 V	12 V
e ⁽¹⁾	25,0 ⁽¹²⁾	25,0 ± 0,1
f ⁽¹⁾	3,2 ⁽¹²⁾	3,2 ± 0,1
g	0,5 min.	under consideration
h1	0 ⁽¹²⁾	0 ± 0,1
h2	0 ⁽¹²⁾	0 ± 0,15
γ1	50° min.	50° min.
γ2	40° min.	40° min.
γ3	30° min.	30° min.

Cap: H16: PGJ19-3 in accordance with IEC Publication 60061 (sheet 7004-110-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	19	19
Test voltage	Volts	13,2	13,2
Objective values	Watts	22 max.	22 max.
	Luminous flux	500 + 10 % / - 15 %	

Reference luminous flux: 500 lm at approximately 13,2 V

Reference luminous flux: 550 lm at approximately 13,5 V

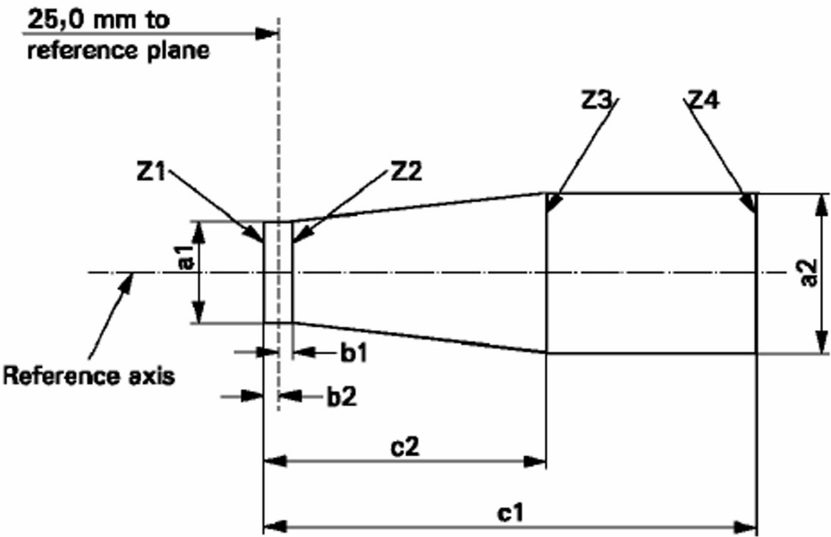
⁽¹⁾ The ends of the filament are defined as the points where, when the viewing direction is direction A as shown in Figure 1 on sheet H16/1, the projection of the outside of the end turns crosses the filament axis.

⁽¹²⁾ To be checked by means of a 'Box System'; sheet H16/4.

CATEGORY H16 — Sheet H16/4

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament complies with the requirements.



a1	a2	b1	b2	c1	c2
d + 0,50	d + 0,70	0,25		3,6	2,6

d = diameter of filament

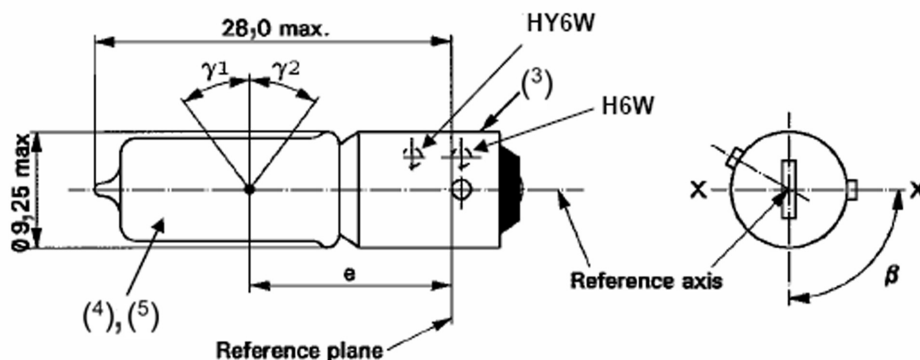
The filament position is checked solely in directions A and B as shown on sheet H16/1, Figure 1.

The filament shall lie entirely within the limits shown.

The ends of the filament as defined on sheet H16/3, note 11, shall lie between lines Z1 and Z2 and between Z3 and Z4.

CATEGORIES H6W AND HY6W — Sheet H6W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e	14,25	15,0	15,75	15,0 ± 0,25
Lateral deviation ⁽¹⁾			0,75	0,4 max
β	82,5°	90°	97,5°	90° ± 5°
γ1, γ2 ⁽²⁾	30°			30° min.

Cap: H6W: BAX9s in accordance with IEC Publication 60061 (sheet 7004-8-1)
 HY6W: BAZ9s in accordance with IEC Publication 60061 (sheet 7004-150-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts		12	12
	Watts		6	6
Test voltage	Volts		13,5	13,5
Objective values	Watts		7,35 max.	7,35 max.
	Luminous flux	H6W	125 ± 12 %	
		HY6W	75 ± 17 %	
Reference luminous flux at approximately 13,5 V				White: 125 lm
				Amber: 75 lm

⁽¹⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

⁽²⁾ In the area between the outer legs of the angles 1 and 2, the bulb shall have no optically distorting areas and the curvature of the bulb shall have a radius not less than 50 per cent of the actual bulb diameter.

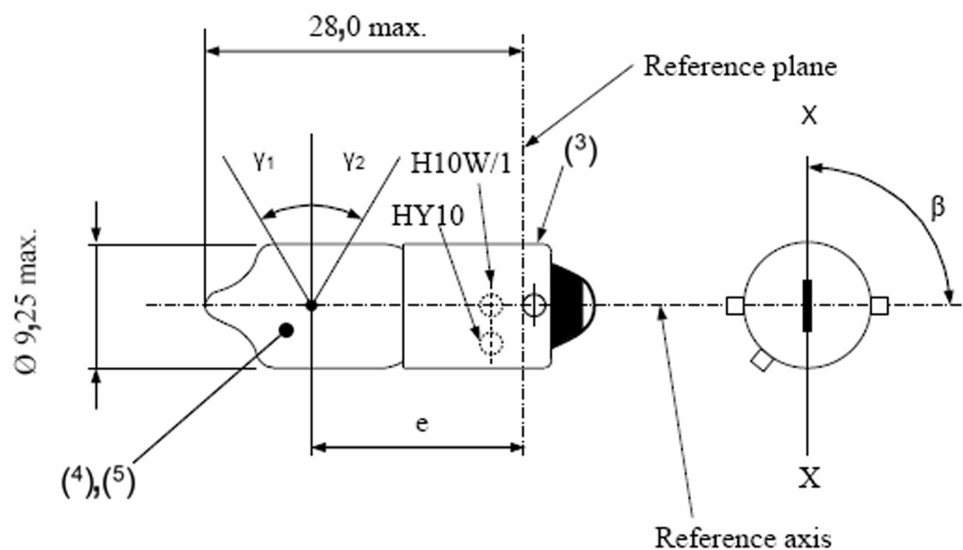
⁽³⁾ Over the entire length of the cap there shall be no projections or soldering exceeding the permissible maximum diameter of the cap.

⁽⁴⁾ The light emitted from filament lamps of normal production shall be white for category H6W and amber for category HY6W.

⁽⁵⁾ The light emitted from standard filament lamps shall be white for category H6W and amber or white for category HY6W.

CATEGORIES H10W/1 AND HY10W — Sheet H10W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e	14,25	15,0	15,75	15,0 ± 0,25
Lateral deviation ⁽¹⁾			0,75	0,4 max
β	82,5°	90°	97,5°	90° ± 5°
γ_1, γ_2 ⁽²⁾	30°			30° min.

Cap H10W/1: BAU9s in accordance with IEC Publication 60061 (sheet 7004-150A-1)
 HY10W: BAUZ9s in accordance with IEC Publication 60061 (sheet 7004-150B-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts		12	12
	Watts		10	10
Test voltage	Volts		13,5	13,5
Objective values	Watts		12 max.	12 max.
	Luminous flux	H10W/1	200 ± 12 %	
		HY10W	120 ± 17 %	
Reference luminous flux at approximately 13,5 V				White: 200 lm
				Amber: 120 lm

⁽¹⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

⁽²⁾ In the area between the outer legs of the angles γ_1 and γ_2 , the bulb shall have no optically distorting areas and the curvature of the bulb shall have a radius not less than 50 per cent of the actual bulb diameter.

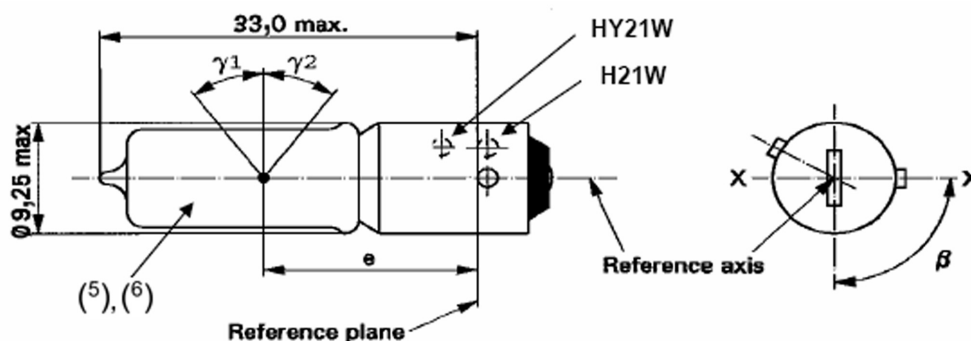
⁽³⁾ Over the entire length of the cap there shall be no projections or soldering exceeding the permissible maximum diameter of the cap.

⁽⁴⁾ The light emitted from filament lamps of normal production shall be white for category H10W/1 and amber for category HY10W.

⁽⁵⁾ The light emitted from standard filament lamps shall be white for category H10W/1 and amber or white for category HY10W.

CATEGORIES H21W AND HY21W — Sheet H21W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm		Filament lamps of normal production			Standard filament lamp
		min.	nom.	max.	
e			20,0 ⁽¹⁾		20,0 ± 0,25
f	12 V			3,8	3,8 + 0/ - 1
	24 V			4,5	
Lateral deviation ⁽²⁾				⁽³⁾	0,0 ± 0,15 ⁽⁴⁾
β		82,5°	90°	97,5°	90° ± 5°
γ ¹ , γ ² ⁽⁵⁾		45°			45° min.

Cap: H21W: BAY9s in accordance with IEC Publication 60061 (sheet 7004-9-1)

HY21W: BAW9s in accordance with IEC Publication 60061 (sheet 7004-149-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts		12	24	12
	Watts		21	21	21
Test voltage	Volts		13,5	28,0	13,5
Objective values	Watts		26,25 max.	29,4 max.	26,25 max.
	Luminous flux	H21W	600 ± 12 %	600 ± 15 %	
		HY21W	300 ± 17 %	300 ± 20 %	
Reference luminous flux at approximately				12 V	White: 415 lm
				13,2 V	White: 560 lm
				13,5 V	White: 600 lm Amber: 300 lm

⁽¹⁾ To be checked by means of a 'Box system', sheet H21W/2.

⁽²⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

⁽³⁾ The lateral deviation with respect to the plane perpendicular to axis X-X is measured in the position described in paragraph 1 of the test procedure specified on sheet H21W/2.

⁽⁴⁾ In the area between the outer legs of the angles γ¹ and γ², the bulb shall have no optical distorting areas and the curvature of the bulb shall have a radius not less than 50 per cent of the actual bulb diameter.

⁽⁵⁾ The light emitted from filament lamps of normal production shall be white for category H21W and amber for category HY21W.

⁽⁶⁾ The light emitted from standard filament lamps shall be white for category H21W and amber or white for category HY21W.

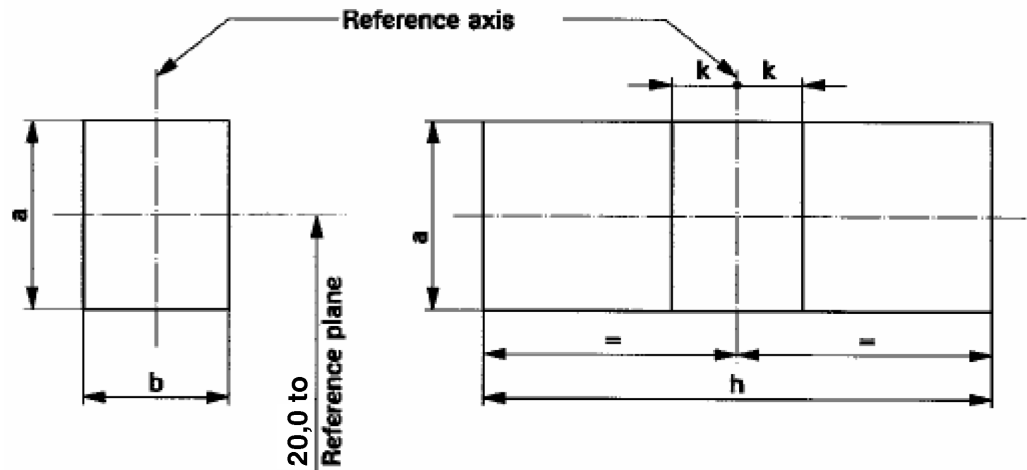
CATEGORIES H21W AND HY21W — Sheet H21W/2

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane and has an axis perpendicular, within $\pm 7,5^\circ$, to the plane through the centre line of the reference pin and the reference axis, whether a filament lamp complies with the requirements

Side elevation

Front elevation



Reference	a	b	h	k
Dimension	d + 1,0	d + 1,0	f + 1,2	0,50

d = diameter of filament
f = actual filament length

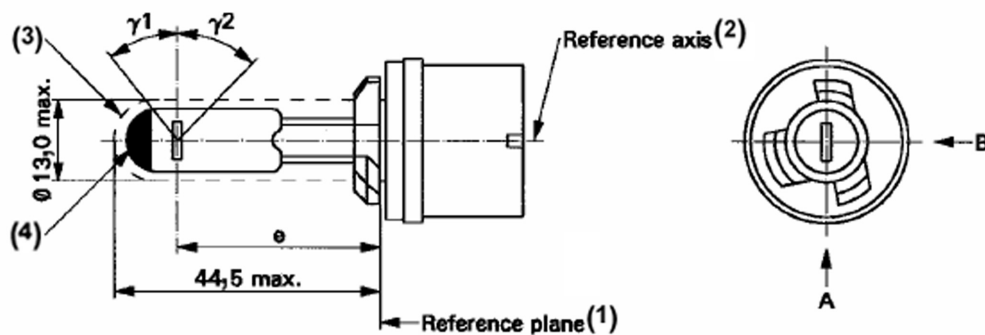
Test procedures and requirements

1. The filament lamp is placed in a holder capable of being rotated about its axis and having either a calibrated scale or fixed stops corresponding to the angular displacement tolerance limits. The holder is then so rotated that an end view of the filament is seen on the screen on to which the image of the filament is projected. The end view of the filament shall be obtained within the angular displacements tolerance limits.
2. Side elevation
The filament lamp placed with the cap down, the reference axis vertical and the filament seen end-on, the projection of the filament shall lie entirely within a rectangle of height 'a' and width 'b', having its centre at the theoretical position of the centre of the filament.
3. Front elevation
The filament lamp placed with the cap down and the reference axis vertical, the filament lamp being viewed in a direction at right angles to the filament axis:
 - 3.1. the projection of the filament shall lie entirely within a rectangle of height 'a' and width 'h', having its centre at the theoretical position of the centre of the filament;
 - 3.2. the centre of the filament shall not be offset by more than distance 'k' from the reference axis.

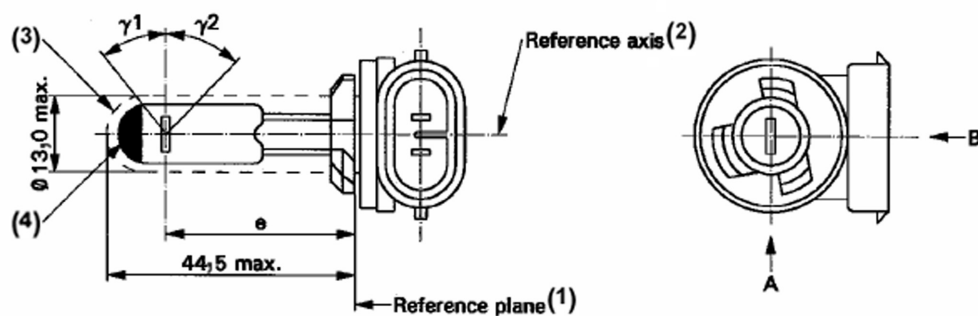
CATEGORIES H27W/1 AND H27W/2 — Sheet H27W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

CATEGORY H27W/1



CATEGORY H27W/2



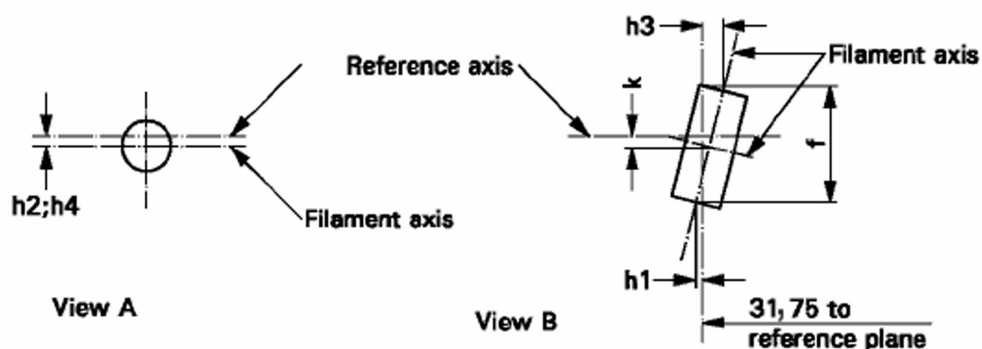
(¹) The reference plane is defined by the plane formed by the underside of the bevelled lead-in flange of the cap.

(²) The reference axis is perpendicular to the reference plane and passes through the centre of the 13,10 mm cap diameter.

(³) Glass bulb and supports shall not exceed the size of a theoretical cylinder centred on the reference axis.

(⁴) The obscuration shall extend over the whole bulb top including the bulb cylindrical portion up to the intersection with γ_1 .

CATEGORIES H27W/1 AND H27W/2 — Sheet H27W/2



Filament dimensions and position

(Dimensions f for all filament lamps)

(Dimensions h1, h2, h3, h4 and k for standard filament lamps only)

Dimensions in mm	Filament lamp of normal production	Standard filament lamp
e	31,75 ⁽⁶⁾	31,75 ± 0,25
f ⁽⁸⁾	4,8 max.	4,2 ± 0,20
k	0 ⁽⁶⁾	0,0 ± 0,25
h1, h2, h3, h4 ⁽⁷⁾	0 ⁽⁶⁾	0,0 ± 0,25
γ1 ⁽⁵⁾	38° nom.	38° nom.
γ2 ⁽⁵⁾	44° nom.	44° nom.

Cap: H27W/1: PG13 in accordance with IEC Publication 60061 (sheet 7004-107-4)
H27W/2: PGJ13

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	27	27
Test voltage	Volts	13,5	13,5
Objective values	Watts	31 max.	31 max.
	Luminous flux	477 ± 15 %	
Reference luminous flux at approximately		12 V	350 lm
		13,2 V	450 lm
		13,5 V	477 lm

⁽⁵⁾ Glass bulb shall be optically distortion free within the angles γ1 and γ2. This requirement applies to the whole bulb circumference within the angles γ1 and γ2.

⁽⁶⁾ To be checked by means of a 'Box System', sheet H27W/3.

⁽⁷⁾ For standard filament lamps, the points to be measured are those where the projection of the outside of the end turns crosses the filament axis.

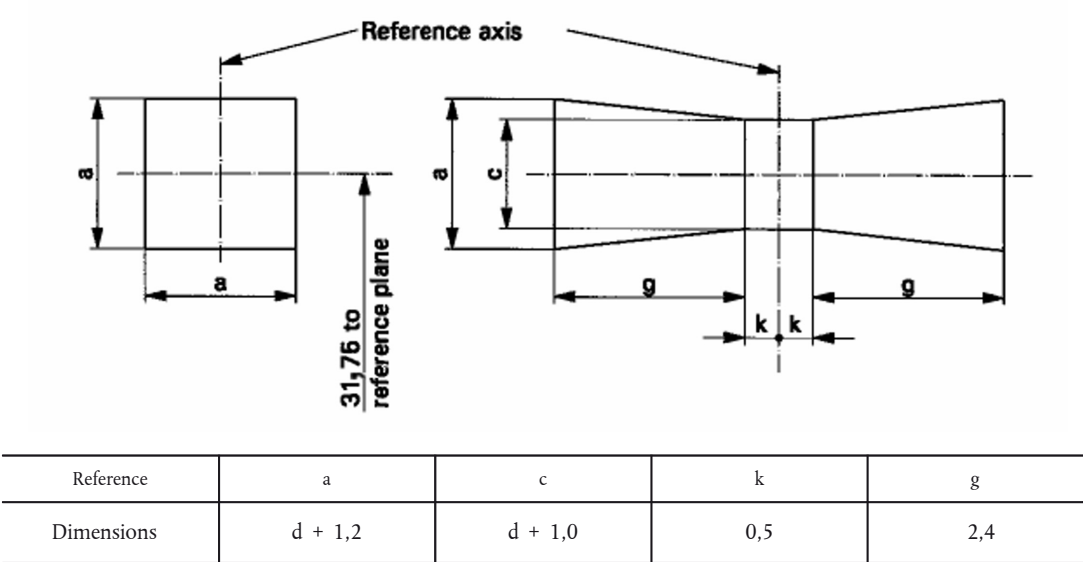
⁽⁸⁾ The ends of the filament are defined by the intersections of the outside of the first and of the last light emitting turn, respectively, with the plane parallel to and 31,75 mm from the reference plane.

CATEGORIES H27W/1 AND H27W/2 — Sheet H27W/3

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.

(Dimensions in mm)



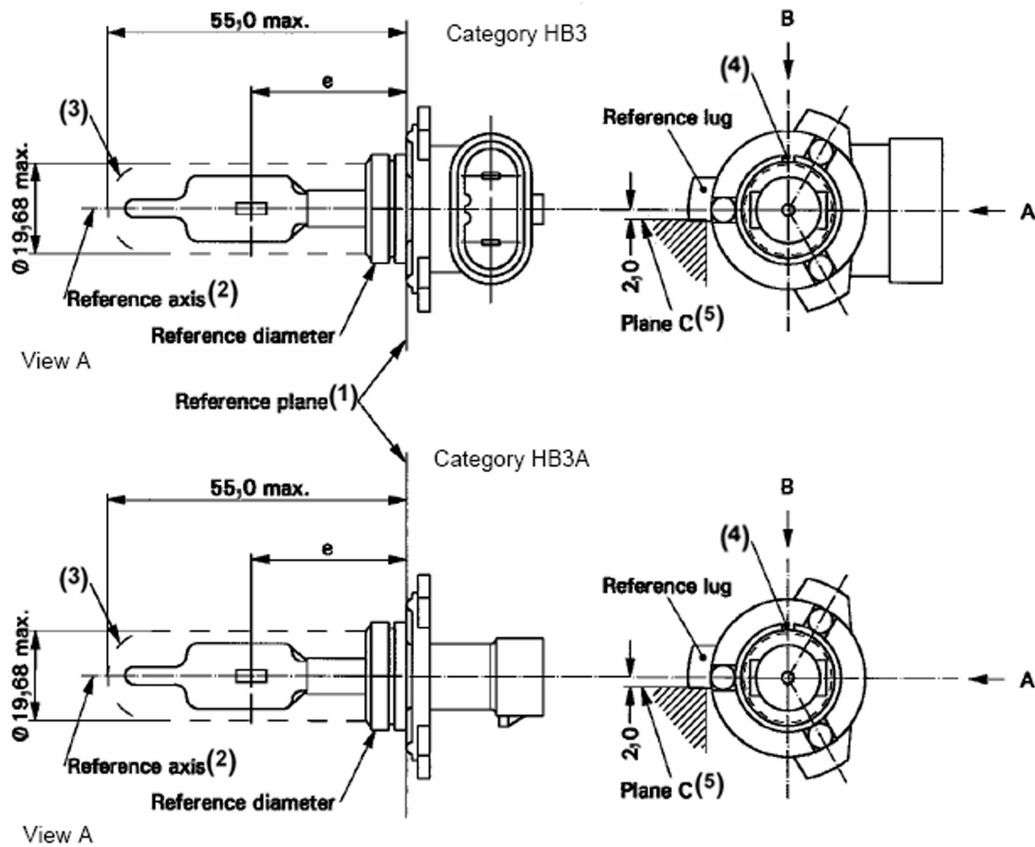
d = diameter of filament

The filament shall lie entirely within the limits shown.

The centre of the filament shall lie within the limits of dimension k.

CATEGORIES HB3 AND HB3A — Sheet HB3/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



(1) The reference plane is the plane defined by the meeting points of cap-holder fit.

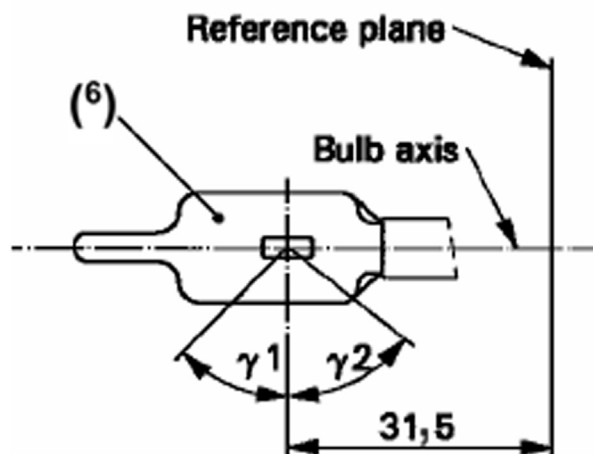
(2) The reference axis is perpendicular to the reference plane and concentric with the reference diameter of the cap.

(3) Glass bulb and supports shall not exceed the envelope and shall not interfere with insertion past the lamp key.

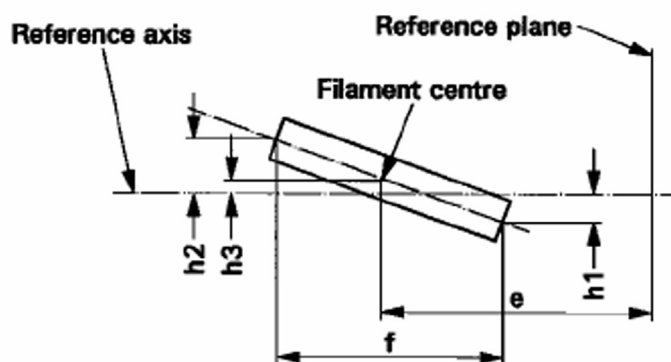
(4) The keyway is mandatory for category HB3A and optional for category HB3.

(5) The filament lamp shall be rotated in the measuring holder until the reference lug contacts plane C of the holder.

CATEGORIES HB3 AND HB3A — Sheet HB3/2

Distortion free area ⁽⁷⁾

Filament position and dimensions



⁽⁶⁾ The colour of the light emitted shall be white or selective-yellow.

⁽⁷⁾ Glass bulb periphery shall be optically distortion-free axially within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 .

CATEGORIES HB3 AND HB3A — Sheet HB3/3

Dimensions in mm ⁽¹²⁾		Tolerances	
		Filament lamps of normal production	Standard filament lamp
e ⁽⁹⁾ ⁽¹¹⁾	31,5	⁽¹⁰⁾	± 0,16
f ⁽⁹⁾ ⁽¹¹⁾	5,1	⁽¹⁰⁾	± 0,16
h1, h2	0	⁽¹⁰⁾	± 0,15 ⁽⁸⁾
h3	0	⁽¹⁰⁾	± 0,08 ⁽⁸⁾
1	45° min.	—	—
2	52° min.	—	—

Cap P20d in accordance with IEC Publication 60061 (sheet 7004-31-2) ⁽¹³⁾

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	60	60
Test voltage	Volts	13,2	13,2
Objective values	Watts	73 max.	73 max.
	Luminous flux	1 860 ± 12 %	
Reference luminous flux at approximately		12 V	1 300
		13,2 V	1 860

⁽⁸⁾ The eccentricity is measured only in viewing directions (*) A and B as shown in the figure on sheet HB3/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

⁽⁹⁾ The viewing direction is direction (*) B as shown in the figure on sheet HB3/1.

⁽¹⁰⁾ To be checked by means of a 'Box-System'; sheet HB3/4 (*).

⁽¹¹⁾ The ends of the filament are defined as the points where, when the viewing direction (*) as defined in note ⁽⁹⁾ above, the projection of the outside of the end turns crosses the filament axis.

⁽¹²⁾ Dimensions shall be checked with O-ring removed.

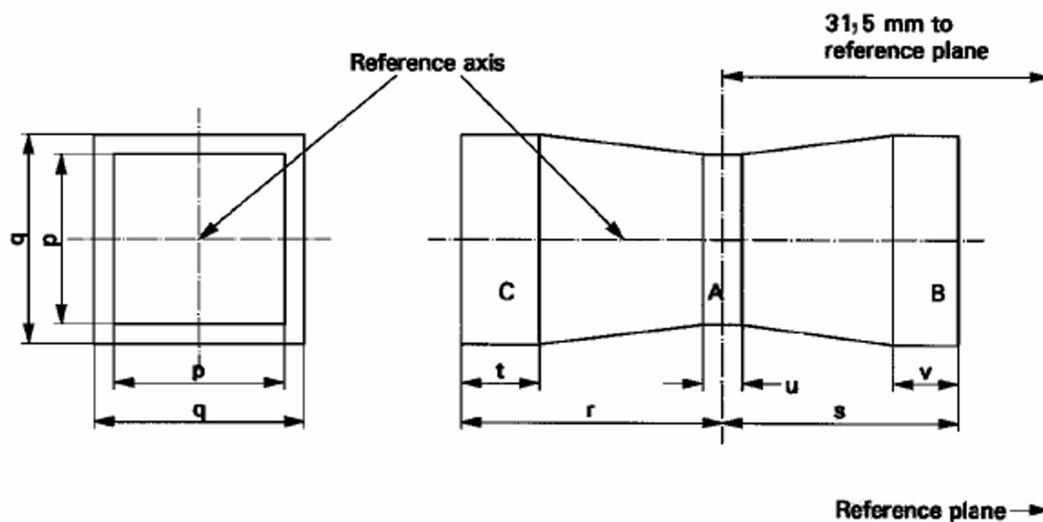
⁽¹³⁾ Filament lamp HB3 shall be equipped with the right-angle cap and filament lamp HB3A with the straight cap.

(*) Manufacturers may choose another set of perpendicular viewing directions. The viewing directions specified by the manufacturer are to be used by the testing laboratory when checking filament dimensions and position.

CATEGORIES HB3 AND HB3A — Sheet HB3/4

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



	p	q	r	s	t	u	v
12 V	1,3 d	1,6 d	3,0	2,9	0,9	0,4	0,7

d = diameter of filament

The filament position is checked solely in directions A and B as shown on sheet HB3/1.

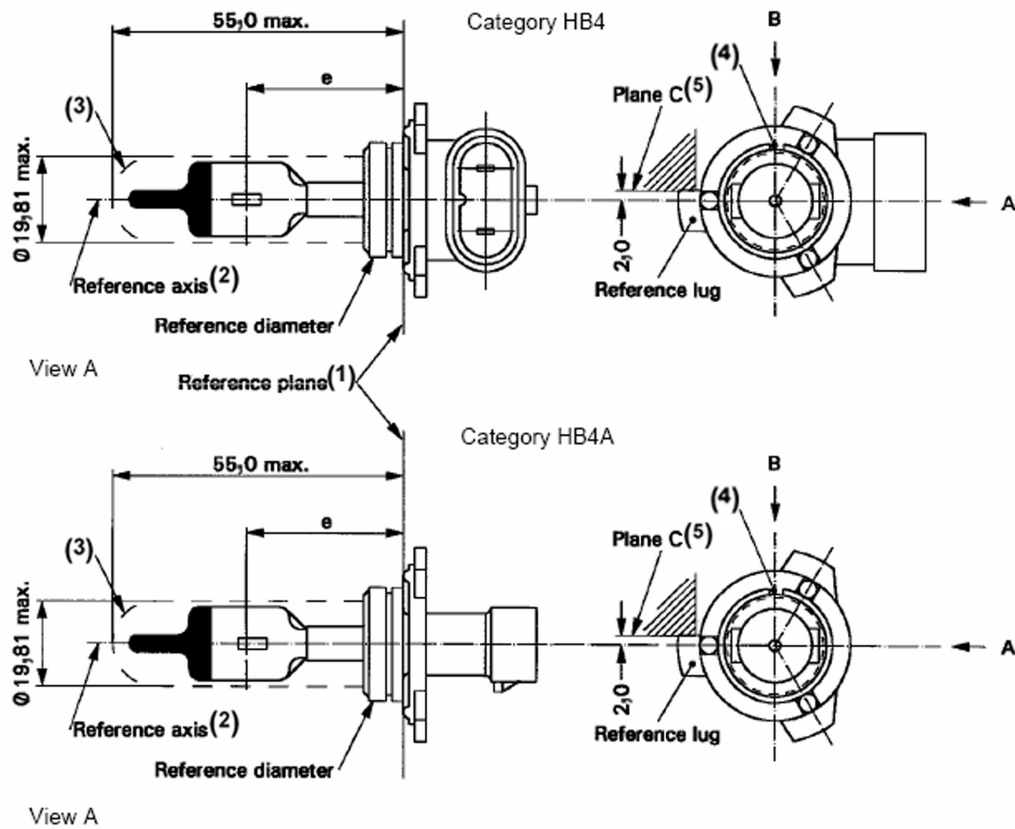
The filament shall lie entirely within the limits shown.

The beginning of the filament as defined on sheet HB3/3, note 11, shall lie in volume 'B' and the end of the filament in volume 'C'.

Volume 'A' does not involve any filament centre requirement.

CATEGORIES HB4 AND HB4A — Sheet HB4/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



(¹) The reference plane is the plane defined by the meeting points of cap-holder fit.

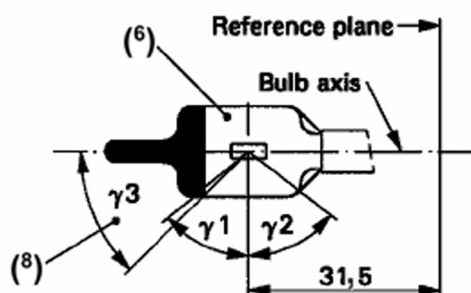
(²) The reference axis is perpendicular to the reference plane and concentric with the reference diameter of the cap.

(³) Glass bulb and supports shall not exceed the envelope and shall not interfere with insertion past the lamp key. The envelope is concentric to the reference axis.

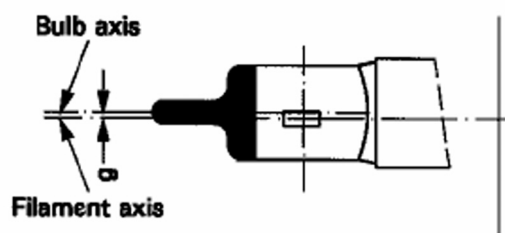
(⁴) The keyway is mandatory for category HB4A and optional for category HB4.

(⁵) The filament shall be rotated in the measuring holder until the reference lug contacts plane C of the holder.

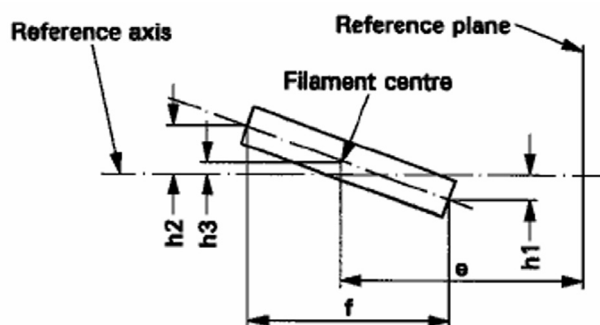
CATEGORIES HB4 AND HB4A — Sheet HB4/2

Distortion free area ⁽⁷⁾ and black top ⁽⁸⁾

Bulb eccentricity



Filament position and dimensions



⁽⁶⁾ The colour of the light emitted shall be white or selective-yellow.

⁽⁷⁾ Glass bulb periphery shall be optically distortion-free axially and cylindrically within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 and does not need to be verified in the area covered by the obscuration.

⁽⁸⁾ The obscuration shall extend to at least angle γ_3 and shall be at least as far as the undistorted part of the bulb defined by angle γ_1 .

CATEGORIES HB4 AND HB4A — Sheet HB4/3

Dimensions in mm ⁽¹³⁾		Tolerances	
		Filament lamps of normal production	Standard filament lamp
e ⁽¹⁰⁾ ⁽¹²⁾	31,5	⁽¹¹⁾	± 0,16
f ⁽¹⁰⁾ ⁽¹²⁾	5,1	⁽¹¹⁾	± 0,16
h1, h2	0	⁽¹¹⁾	± 0,15 ⁽⁹⁾
h3	0	⁽¹¹⁾	± 0,08 ⁽⁹⁾
g ⁽¹⁰⁾	0,75	± 0,5	± 0,3
γ1	50° min.	—	—
γ2	52° min.	—	—
γ3	45°	± 5°	± 5°

Cap P22d in accordance with IEC Publication 60061 (sheet 7004-32-2) ⁽¹⁴⁾

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	51	51
Test voltage	Volts	13,2	13,2
Objective values	Watts	62 max.	62 max.
	Luminous flux	1 095 ± 15 %	
Reference luminous flux at approximately		12 V	825
		13,2 V	1 095

⁽⁹⁾ The eccentricity is measured only in viewing directions (*) A and B as shown in the figure on sheet HB4/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

⁽¹⁰⁾ The viewing direction is direction (*) B as shown in the figure on sheet HB4/1.

⁽¹¹⁾ To be checked by means of a 'Box-System'; sheet HB4/4 (*).

⁽¹²⁾ The ends of the filament are defined as the points where, when the viewing direction (*) as defined in note 10 above, the projection of the outside of the end turns crosses the filament axis.

⁽¹³⁾ Dimensions shall be checked with O-ring removed.

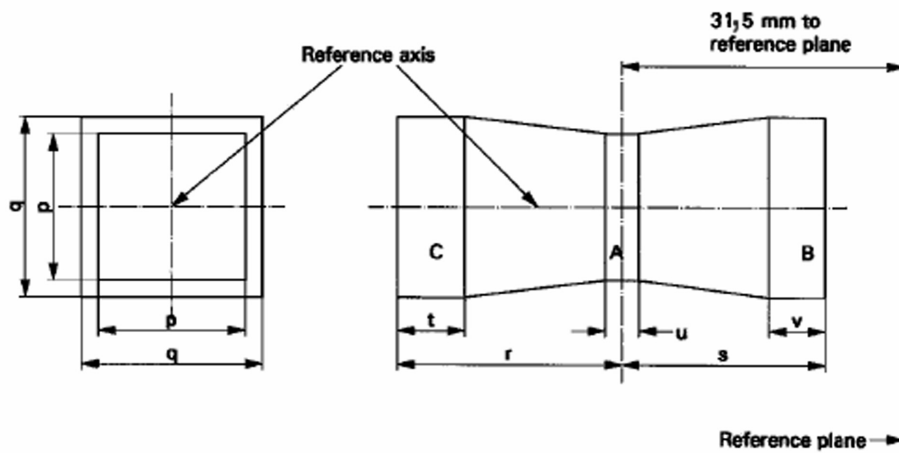
⁽¹⁴⁾ Filament lamp HB4 shall be equipped with the right-angle cap and filament lamp HB4A with the straight cap.

(*) Manufacturers may choose another set of perpendicular viewing directions. The viewing directions specified by the manufacturer are to be used by the testing laboratory when checking filament dimensions and position.

CATEGORIES HB4 AND HB4A — Sheet HB4/4

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



	p	q	r	s	t	u	v
12 V	1,3 d	1,6 d	3,0	2,9	0,9	0,4	0,7

d = diameter of filament

The filament position is checked solely in directions A and B as shown on sheet HB4/1.

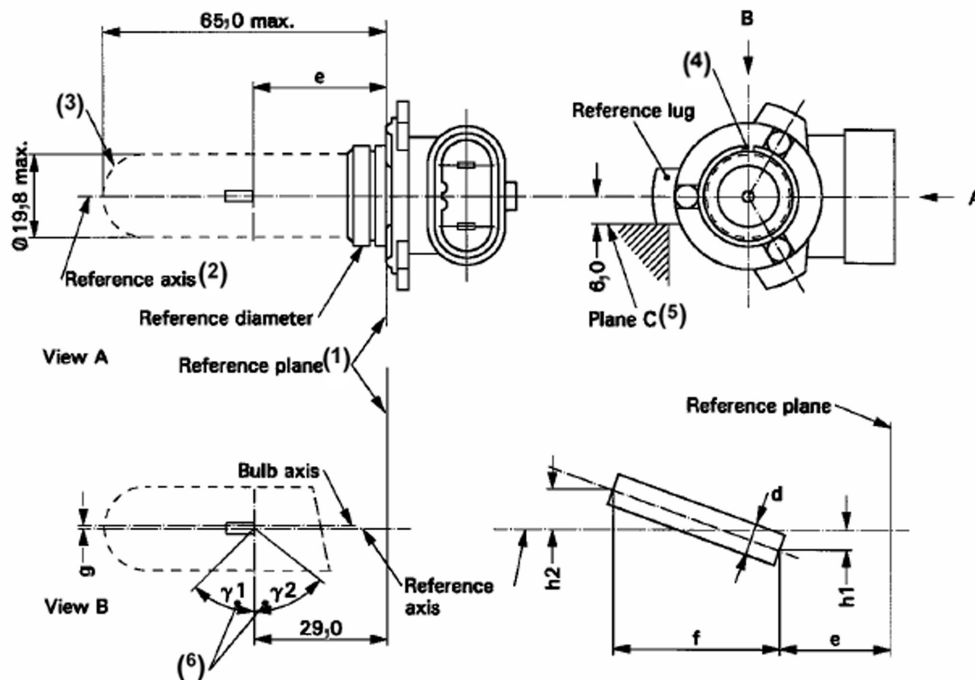
The filament shall lie entirely within the limits shown.

The beginning of the filament as defined on sheet HB4/3 note 12 shall lie in volume 'B' and the end of the filament in volume 'C'.

Volume 'A' does not involve any filament centre requirement.

CATEGORY HIR1 — Sheet HIR1/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



(¹) The reference plane is the plane defined by the three supporting bosses on the cap flange.

(²) The reference axis is perpendicular to the reference plane and concentric with the reference diameter of the cap.

(³) Glass bulb and supports shall not exceed the envelope. The envelope is concentric to the reference axis.

(⁴) The keyway is mandatory.

(⁵) The filament shall be rotated in the measuring holder until the reference lug contacts plane C of the holder.

(⁶) Glass bulb periphery shall be optically distortion-free axially within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 .

CATEGORY HIR1 — Sheet HIR1/2

Dimensions in mm ⁽¹¹⁾		Tolerances	
		Filament lamps of normal production	Standard filament lamp
e ⁽⁸⁾ ⁽¹⁰⁾	29	⁽⁹⁾	± 0,16
f ⁽⁸⁾ ⁽¹⁰⁾	5,1	⁽⁹⁾	± 0,16
g ⁽⁸⁾	0	+ 0,7 / - 0,0	+ 0,4 / - 0,0
h1, h2	0	⁽⁹⁾	± 0,15 ⁽⁷⁾
d	1,6 max.		
γ1	50° min.	—	—
γ2	50° min.	—	—

Cap PX20d in accordance with IEC Publication 60061 (sheet 7004-31-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	65	65
Test voltage	Volts	13,2	13,2
Objective values	Watts	73 max.	73 max.
	Luminous flux	2 500 ± 15 %	
Reference luminous flux at approximately		12 V	1 840
		13,2 V	2 500

⁽⁷⁾ The eccentricity is measured only in viewing directions A and B as shown in the figure on sheet HIR1/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

⁽⁸⁾ The viewing direction is direction B as shown in the figure on sheet HIR1/1.

⁽⁹⁾ To be checked by means of a 'Box-System'; sheet HIR1/3.

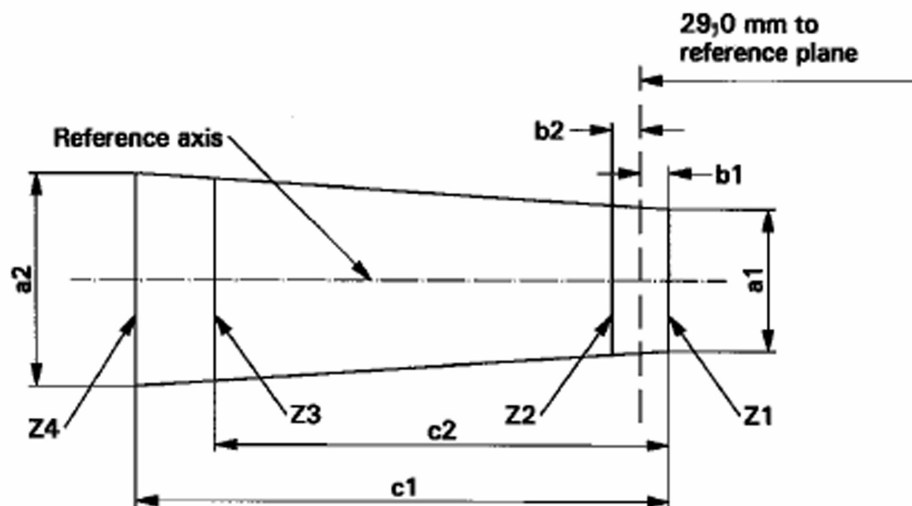
⁽¹⁰⁾ The ends of the filament are defined as the points where, when the viewing direction as defined in note 8 above, the projection of the outside of the end turns crosses the filament axis.

⁽¹¹⁾ Dimensions shall be checked with O-ring mounted.

CATEGORY HIR1 — Sheet HIR1/3

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



	a1	a2	b1	b2	c1	c2
12 V	$d + 0,4$	$d + 0,8$	0,35		6,1	5,2

d = diameter of filament

The filament position is checked solely in directions A and B as shown on sheet HIR1/1.

The ends of the filament as defined on sheet HIR1/2 note 10 shall lie between lines Z1 and Z2 and between lines Z3 and Z4.

CATEGORY HIR2 — Sheet HIR2/2

Dimensions in mm ⁽¹¹⁾		Tolerances	
		Filament lamps of normal production	Standard filament lamp
e ⁽⁸⁾ ⁽¹⁰⁾	28,7	⁽⁹⁾	± 0,16
f ⁽⁸⁾ ⁽¹⁰⁾	5,3	⁽⁹⁾	± 0,16
g ⁽⁸⁾	0	+ 0,7 / - 0,0	+ 0,4 / - 0,0
h1, h2	0	⁽⁹⁾	± 0,15 ⁽⁷⁾
d	1,6 max.	—	—
γ1	50° min.	—	—
γ2	50° min.	—	—
Cap PX22d in accordance with IEC Publication 60061 (sheet 7004-32-2)			
ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS			
Rated values	Volts	12	12
	Watts	55	55
Test voltage	Volts	13,2	13,2
Objective values	Watts	63 max.	63 max.
	Luminous flux	1 875 ± 15 %	
Reference luminous flux at approximately		12 V	1 355
		13,2 V	1 875

⁽⁷⁾ The eccentricity is measured only in viewing directions A and B as shown in the figure on sheet HIR2/1. The points to be measured are those where the projection of the outside of the end turns nearest to or furthest from the reference plane crosses the filament axis.

⁽⁸⁾ The viewing direction is direction B as shown in the figure on sheet HIR2/1.

⁽⁹⁾ To be checked by means of a 'Box-System'; sheet HIR2/3.

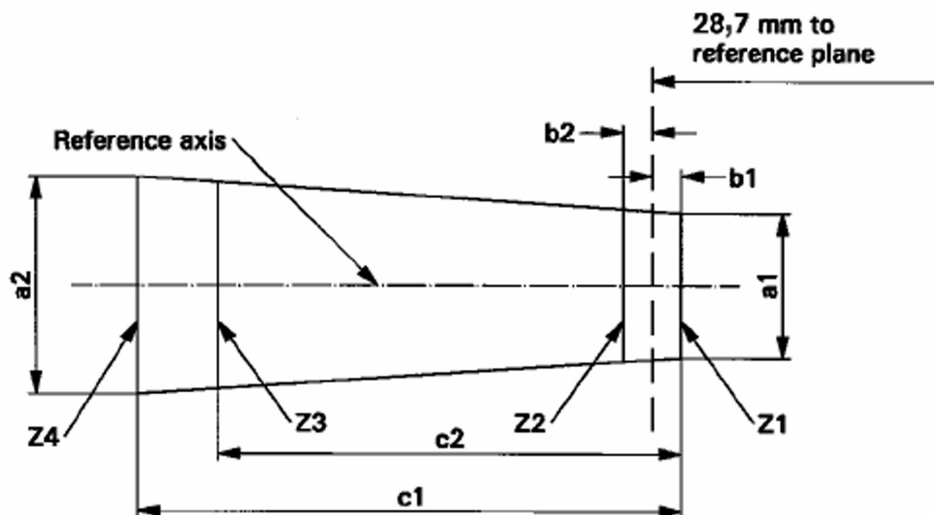
⁽¹⁰⁾ The ends of the filament are defined as the points where, when the viewing direction as defined in note 8 above, the projection of the outside of the end turns crosses the filament axis.

⁽¹¹⁾ Dimensions shall be checked with O-ring removed.

CATEGORY HIR2 — Sheet HIR2/3

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



	a1	a2	b1	b2	c1	c2
12 V	$d + 0,4$	$d + 0,8$	0,35		6,6	5,7

d = diameter of filament

The filament position is checked solely in directions A and B as shown on sheet HIR2/1.

The ends of the filament as defined on sheet HIR2/2 note 10 shall lie between lines Z1 and Z2 and between lines Z3 and Z4.

CATEGORY HS1 — Sheet HS1/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

Figure 1

Main drawing

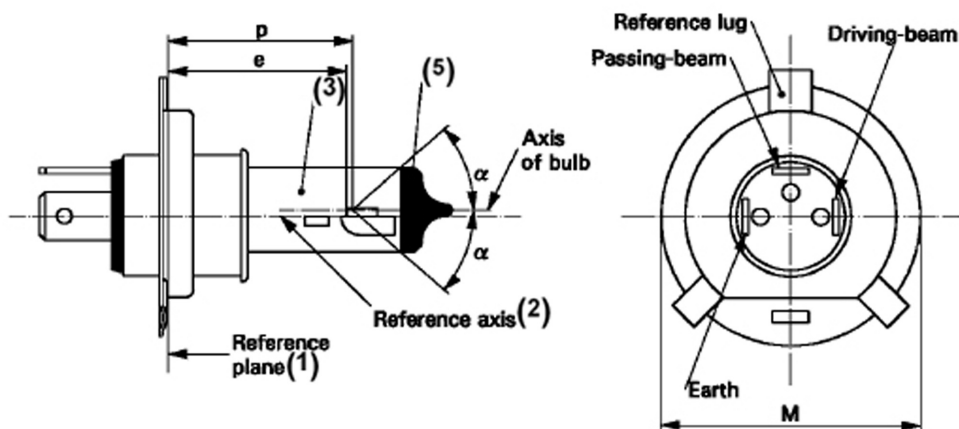
Maximum lamp outlines ⁽⁴⁾

Figure 2

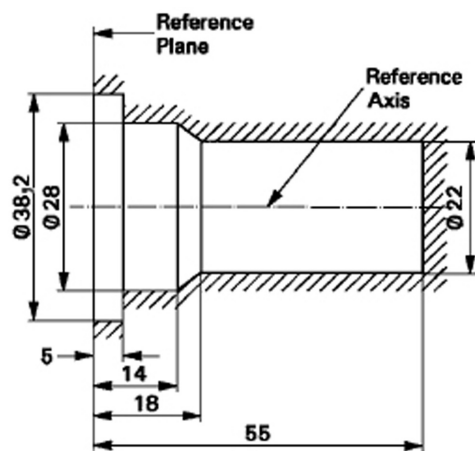
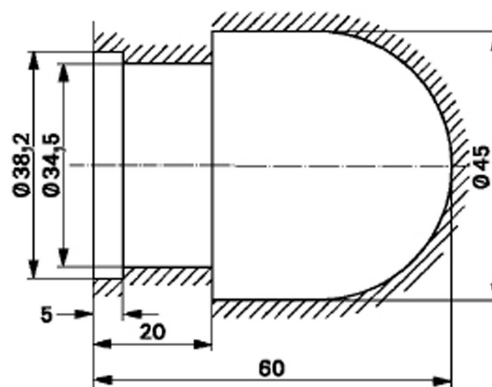


Figure 3



⁽¹⁾ The reference plane is the plane formed by the seating points of the three lugs of the cap ring.

⁽²⁾ The reference axis is perpendicular to the reference plane and passes through the centre of the circle of diameter 'M'.

⁽³⁾ The colour of the light emitted shall be white or selective-yellow.

⁽⁴⁾ The bulb and supports shall not exceed the envelope as in Figure 2. However, where a selective-yellow outer bulb is used the bulb and supports shall not exceed the envelope as in Figure 3.

⁽⁵⁾ The obscuration shall extend at least as far as the cylindrical part of the bulb. It shall also overlap the internal shield when the latter is viewed in a direction perpendicular to the reference axis.

CATEGORY HS1 — Sheet HS1/2

Dimensions in mm	Filament lamps of normal production		Standard filament lamp
	6 V	12 V	12 V
e	28,5 + 0,45 / – 0,25		28,5 + 0,20 / – 0,00
p	28,95		28,95
a	max. 40°		max. 40°

Cap PX43t in accordance with IEC Publication 60061 (sheet 7004-34-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

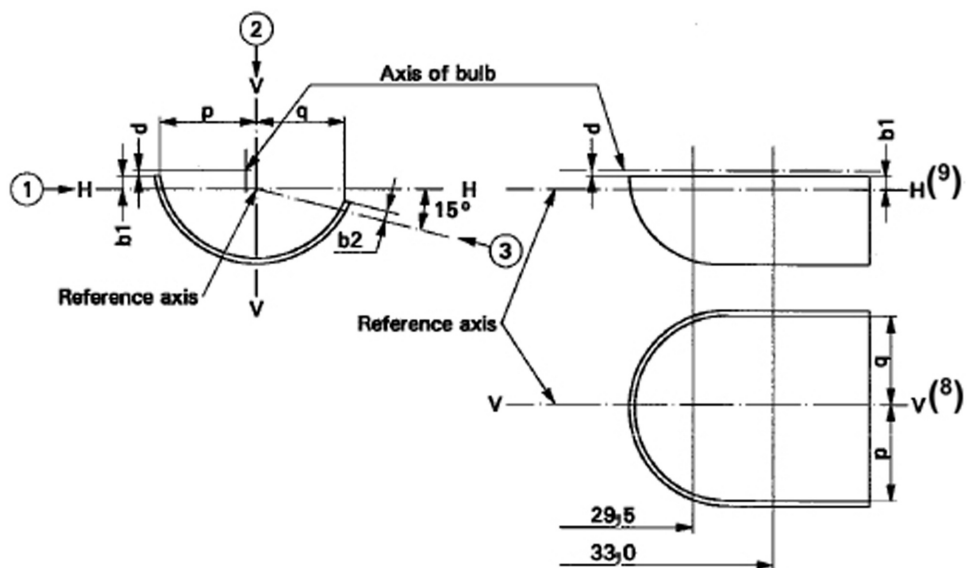
Rated values	Volts	6 ⁽⁶⁾		12 ⁽⁶⁾		12 ⁽⁶⁾	
	Watts	35	35	35	35	35	35
Test voltage	Volts	6,3		13,2		13,2	
Objective values	Watts ± %	35	35	35	35	35	35
		5				5	
	Luminous flux ± %	700	440	825	525		
		15					
Measuring flux ⁽⁷⁾ lm		—		—	450		
Reference luminous flux at approximately				12 V	700	450	
				13,2 V	825	525	

⁽⁶⁾ The values indicated in the left hand column relate to the driving-beam. Those indicated in the right-hand column relate to the passing beam.

⁽⁷⁾ Measuring luminous flux for measuring according to paragraph 3.9 of this Regulation.

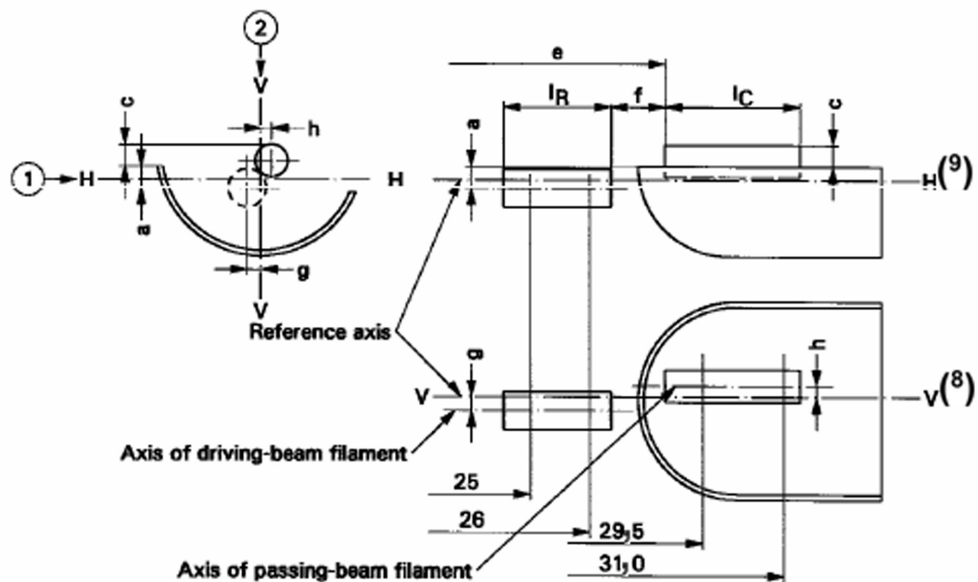
CATEGORY HS1 — Sheet HS1/3

Position of shield



The drawing is not mandatory with respect to the design of the shield

Position of filaments



CATEGORY HS1 — Sheet HS1/4

Table of the dimensions (in mm) referred to in the drawings on sheet HS1/3

Reference (*)		Dimensions (**)		Tolerance		
				Filaments lamps of normal production		Standard filament lamp
6 V	12 V	6 V	12 V	6 V	12 V	12 V
a/26		0,8		± 0,35		± 0,20
a/25		0,8		± 0,55		± 0,20
b1/29,5		0		± 0,35		± 0,20
b1/33		b1/29,5 mv		± 0,35		± 0,15
b2/29,5		0		± 0,35		± 0,20
b2/33		b2/29,5 mv		± 0,35		± 0,15
c/29,5		0,6		± 0,35		± 0,20
c/31		c/29,5 mv		± 0,30		± 0,15
d		min. 0,1 / max. 1,5		—		—
e ⁽¹³⁾		28,5		+ 0,45 / - 0,25		+ 0,20 / - 0,00
f ⁽¹¹⁾ ⁽¹²⁾ ⁽¹³⁾		1,7		+ 0,50 / - 0,30		+ 0,30 / - 0,10
g/26		0		± 0,50		± 0,30
g/25		0		± 0,70		± 0,30
h/29,5		0		± 0,50		± 0,30
h/31		h/29,5 mv		± 0,30		± 0,20
l _R ⁽¹¹⁾ ⁽¹⁴⁾		3,5	4,0	± 0,80		± 0,40
l _C ⁽¹¹⁾ ⁽¹²⁾		3,3	4,5	± 0,80		± 0,35
p/33		Depends on the shape of the shield		—		—
q/33		(p + q) / 2		± 0,60		± 0,30

(*) '.../26' means dimension to be measured at the distance from the reference plane indicated in mm after the stroke.

(**) '29,5 mv' means the value measured at a distance of 29,5 mm from the reference plane.

(8) Plane V-V is the plane perpendicular to the reference plane and passing through the reference axis and through the intersection of the circle of diameter 'M' with the axis of the reference lug.

(9) Plane H-H is the plane perpendicular to both the reference plane and plane V-V and passing through the reference axis.

(10) (Blank).

(11) The end turns of the filament are defined as being the first luminous turn and the last luminous turn that are at substantially the correct helix angle. For coiled-coil filaments, the turns are defined by the envelope of the primary coil.

(12) For the passing-beam filament, the points to be measured are the intersections, seen in direction 1, of the lateral edge of the shield with the outside of the end turns defined under footnote 11.

(13) 'e' denotes the distance from the reference plane to the beginning of the passing beam filament as defined above.

(14) For the driving-beam filament the points to be measured are the intersections, seen in direction 1, of a plane, parallel to plane H-H and situated at a distance of 0,8 mm below it, with the end turns defined under footnote 11.

CATEGORY HS1 — Sheet HS1/5*Additional explanations to sheet HS1/3*

The dimensions below are measured in three directions:

(1) for dimensions a, b1, c, d, e, f, lR and lC;

(2) for dimensions g, h, p and q;

(3) for dimension b2.

Dimensions p and q are measured in planes parallel to and 33 mm away from the reference plane.

Dimensions b1 and b2 are measured in planes parallel to and 29,5 mm and 33 mm away from the reference plane.

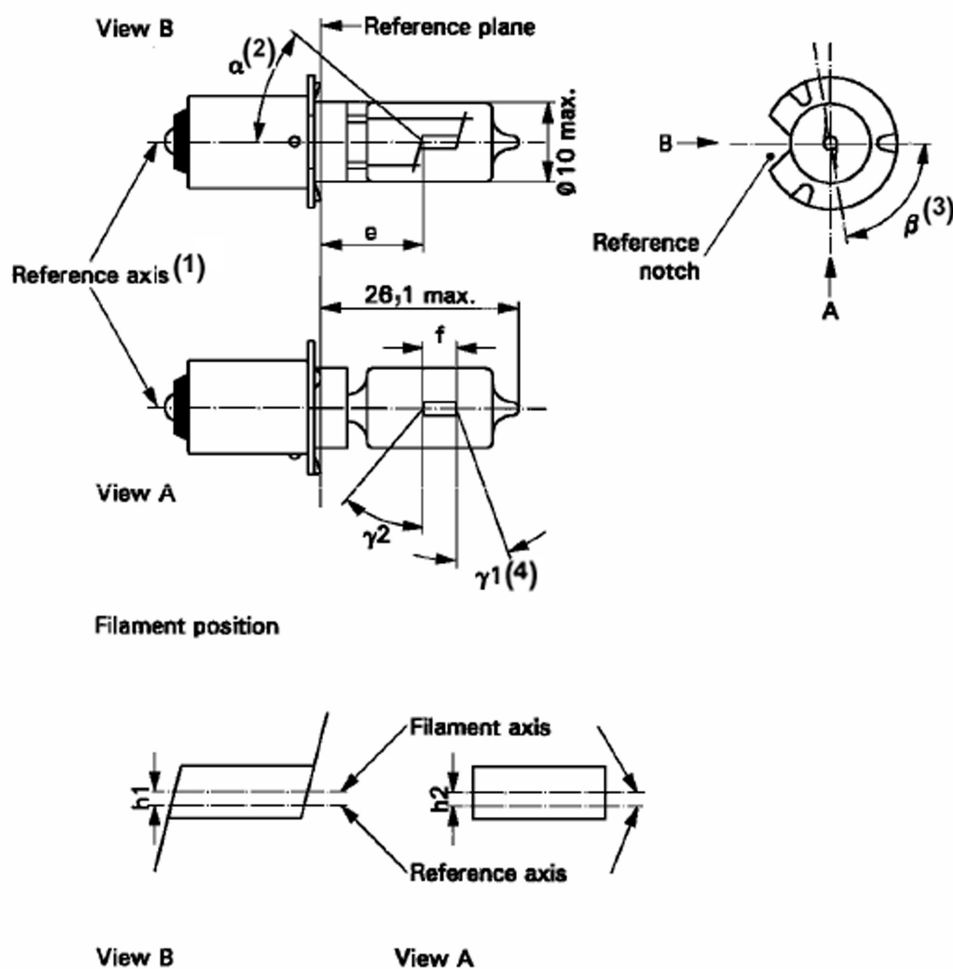
Dimensions a and g are measured in planes parallel to and 25,0 mm and 26,0 mm away from the reference plane.

Dimensions c and h are measured in planes parallel to and 29,5 mm and 31 mm away from the reference plane.

Note: For the method of measurement, see Appendix E of IEC Publication 60809.

CATEGORY HS2 — Sheet HS2/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



(¹) The reference axis is perpendicular to the reference plane and passes through the intersection of this plane with the axis of the cap ring.

(²) All parts which may obscure the light or may influence the light beam shall lie within angle.

(³) Angle denotes the position of the plane through the inner leads with reference to the reference notch.

(⁴) In the area between the outer legs of the angles 1 and 2, the bulb shall have no optically distorting areas and the curvature of the bulb shall have a radius not less than 50 per cent of the actual bulb diameter.

CATEGORY HS2 — Sheet HS2/2

Dimensions in mm		Filament lamps of normal production			Standard filament lamp
		min.	nom.	max.	
e			11,0 ⁽⁵⁾		11,0 ± 0,15
f ⁽⁶⁾	6 V	1,5	2,5	3,0	2,5 ± 0,15
	12 V	2,0	3,0	4,0	
h1, h2			⁽⁵⁾		0 ± 0,15
α ⁽²⁾				40°	
β ⁽³⁾		75°	90°	105°	90° ± 5°
γ ⁽⁴⁾		15°			15° min.
γ ⁽⁴⁾		40°			40° min.

Cap PX13,5s in accordance with IEC Publication 60061 (sheet 7004-35-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	6	12	6
	Watts	15		15
Test voltage	Volts	6,75	13,5	6,75
Objective values	Watts	15 ± 6 %		15 ± 6 %
	Luminous flux	320 ± 15 %		

Reference luminous flux: 320 lm at approximately 6,75 V

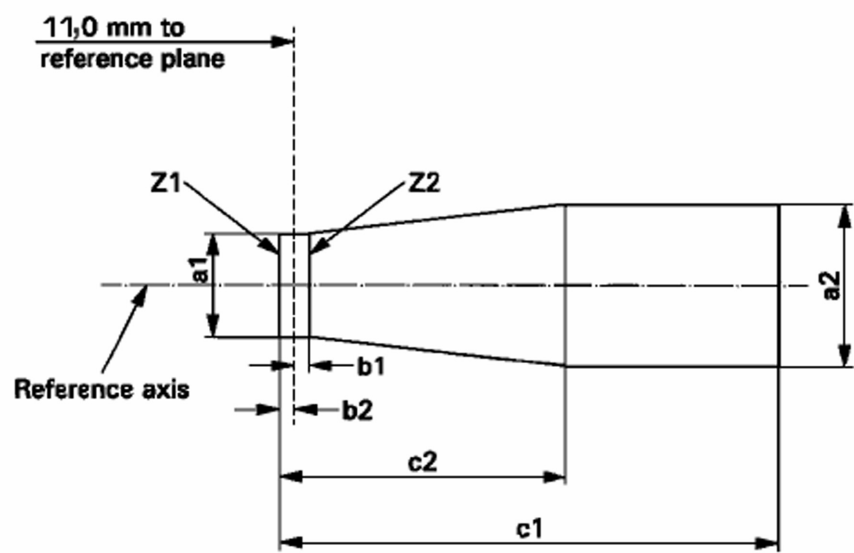
(*) To be checked by means of the 'box system', sheet HS2/3.

(6) In order to avoid rapid filament failure, the supply voltage shall not exceed 8,5 V for 6 V filament lamps and 15 V for 12 V types.

CATEGORY HS2 — Sheet HS2/3

Screen projection requirements

This test is used to determine, by checking whether the filament lamp complies with the requirements by checking whether the filament lamp is correctly positioned relative to the reference axis and reference plane.



Reference	a1	a2	b1	b2	c1 (6 V)	c1 (12 V)	c2
Dimension	d + 1,0	d + 1,4	0,25	0,25	4,0	4,5	1,75

d = actual filament diameter

The filament shall lie entirely within the limits shown.

The beginning of the filament shall lie between the lines Z1 and Z2.

CATEGORY HS5 — Sheet HS5/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

FILAMENT LAMP FOR MOTORCYCLES

Figure 1

Main drawing

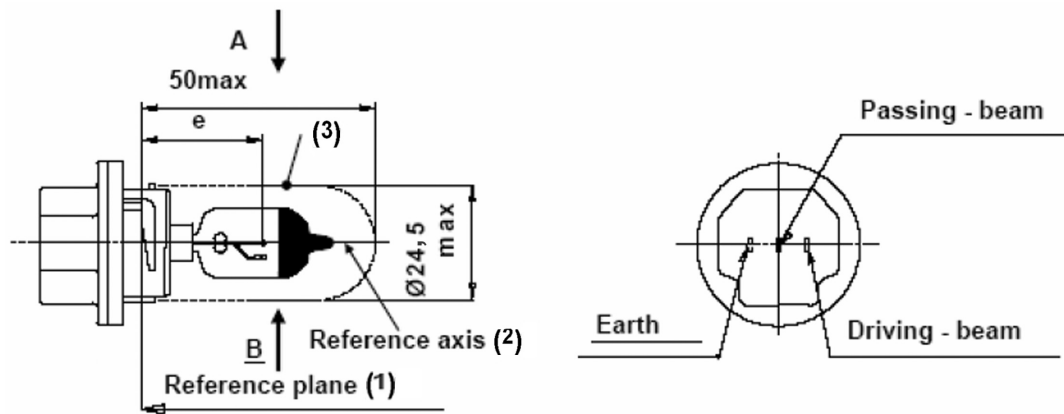
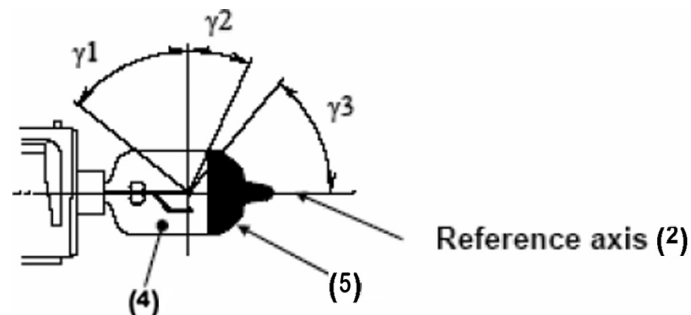


Figure 2

Distortion free area ⁽⁴⁾ and black top ⁽⁵⁾

⁽¹⁾ The reference plane is defined by the three ramp inside surface.

⁽²⁾ The reference axis is perpendicular to the reference plane and passing through the centre of the 23 mm cap diameter.

⁽³⁾ Glass bulb and supports shall not exceed the envelope as indicated in Figure 1. The envelope is concentric to the reference axis.

⁽⁴⁾ Glass bulb shall be optically distortion free within the angles 1 and 2. This requirement applies to the whole bulb circumference within the angles 1 and 2.

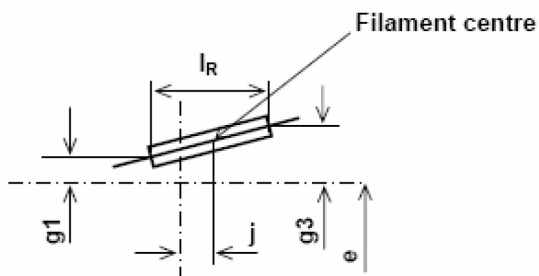
⁽⁵⁾ The obscuration shall extend at least to angle 3 and shall extend at least to the cylindrical part of the bulb on the whole top circumference.

CATEGORY HS5 — Sheet HS5/2

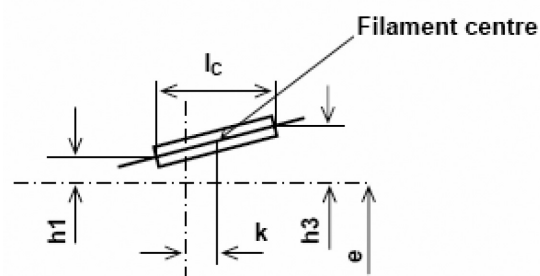
Figure 3

Filament position and dimensions

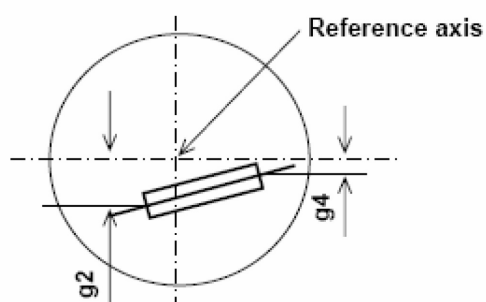
View B of driving-beam filament



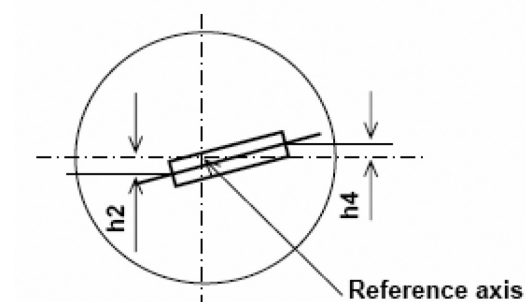
View A of passing-beam filament



Top view of driving-beam filament



Top view of passing-beam filament



CATEGORY HS5 — Sheet HS5/3

Dimensions in mm		Filament lamps of normal production	Standard filament lamp
		12 V	12 V
e	26	(6)	± 0,15
l _C (7)	4,6		± 0,3
k	0		± 0,2
h1, h3	0		± 0,15
h2, h4	0		± 0,20
l _R (7)	4,6		± 0,3
j	0		± 0,2
g1, g3	0		± 0,30
g2, g4	2,5		± 0,40
γ ¹	50° min.	—	—
γ ²	23° min.	—	—
γ ³	50° min.	—	—

Cap P23t in accordance with IEC Publication 60061 (sheet 7004-138-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Voltage	V	12		12	
	Wattage	W	35	30	35	30
Test voltage		V	13,2		13,2	
Objective Values	Wattage	W	40 max.	37 max.	40 max.	37 max.
	Luminous flux	lm	620	515		
		± %	15	15		
Reference luminous at approximately				12 V	460	380
				13,2 V	620	515

(6) To be checked by means of a 'Box-System'. Sheet HS5/4.

(7) The positions of the first and the last turn of the filament are defined by the intersections of the outside of the first and the outside of the last light-emitting turn, respectively, with the plane parallel to and 26 mm distant from the reference plane.

CATEGORY HS5 — Sheet HS5/4

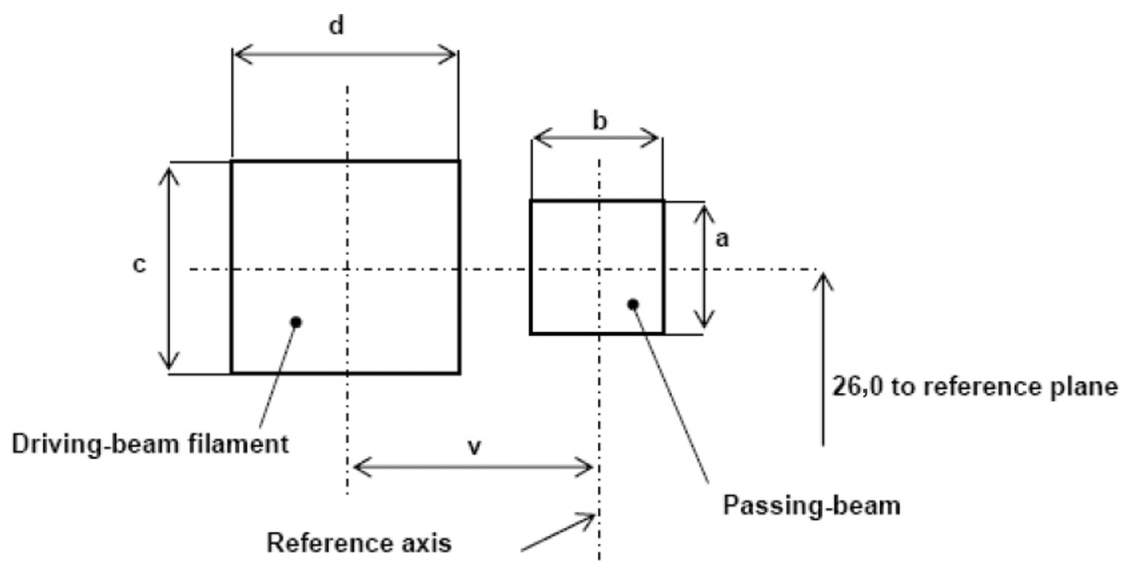
Screen projection requirement

This test is used to determine whether a filament lamp complies with the requirements by checking whether:

- (a) the passing-beam filament is correctly positioned relative to the reference axis and the reference plane; and whether
- (b) the driving-beam filament is correctly positioned relative to the passing-beam filament.

(Dimensions in millimeters)

Side elevation

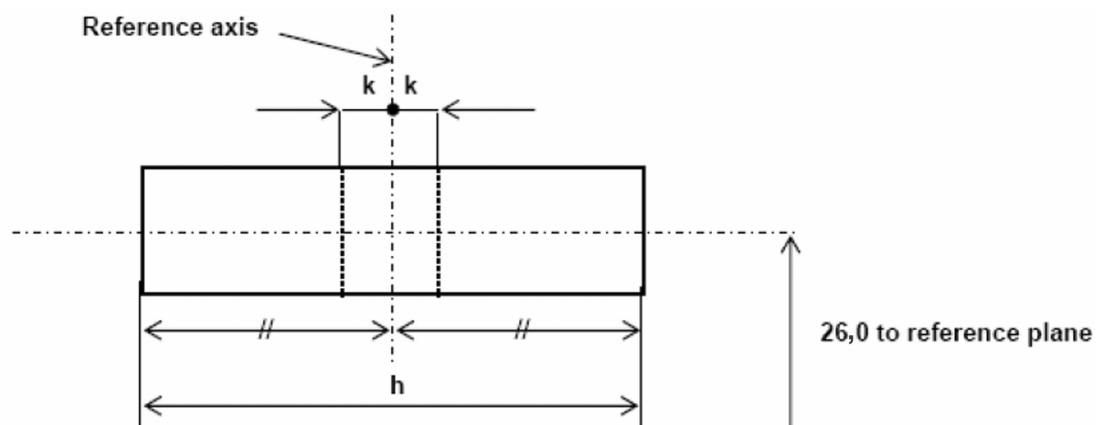


Reference	a	b	c	d	v
Dimensions	$d1 + 0,6$	$d1 + 0,8$	$d2 + 1,2$	$d2 + 1,6$	2,5

$d1$ = Diameter of the passing-beam filament

$d2$ = Diameter of the driving-beam filament

Front elevation



Reference	h	k
Dimensions	6,0	0,5

The filaments shall lie entirely within the limits shown.

The centre of the filament shall lie within the limits of dimension k .

CATEGORY HS5A — Sheet HS5A/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

FILAMENT LAMP FOR MOTORCYCLES

Figure 1

Main drawing

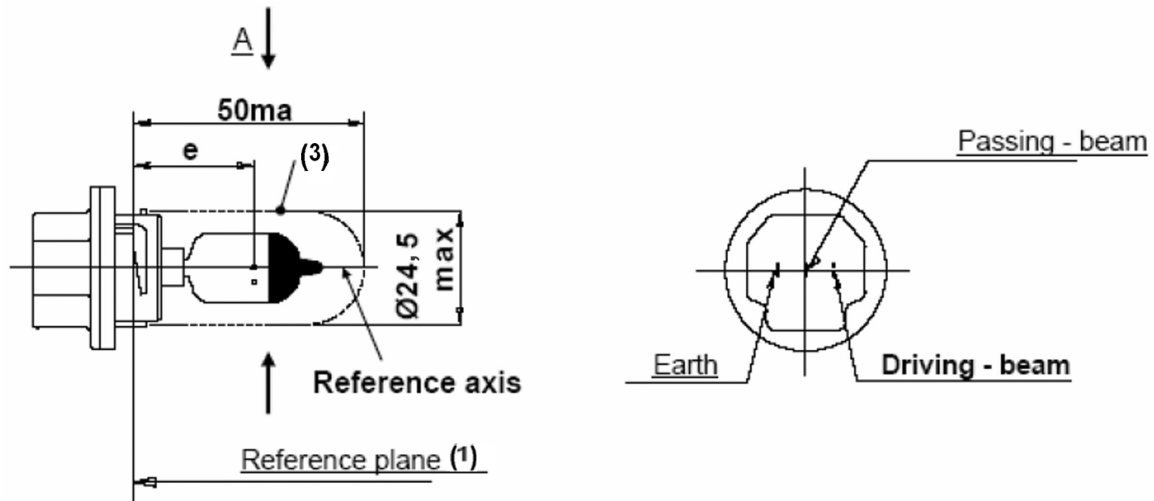
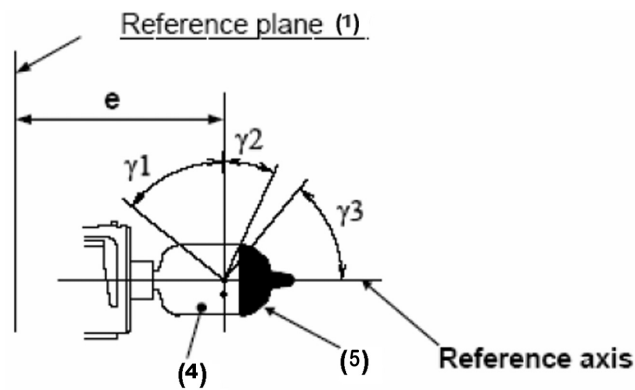


Figure 2

Distortion free area ⁽⁴⁾ and black top ⁽⁵⁾

⁽¹⁾ The reference plane is defined by three ramps inside surface.

⁽²⁾ The reference axis is perpendicular to the reference plane and passing through the centre of the 23 mm cap diameter.

⁽³⁾ Glass bulb and supports shall not exceed the envelope as indicated in figure 1. The envelope is concentric to the reference axis.

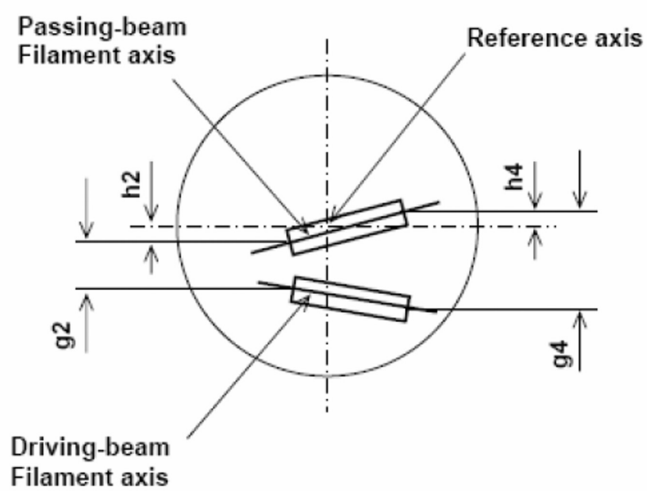
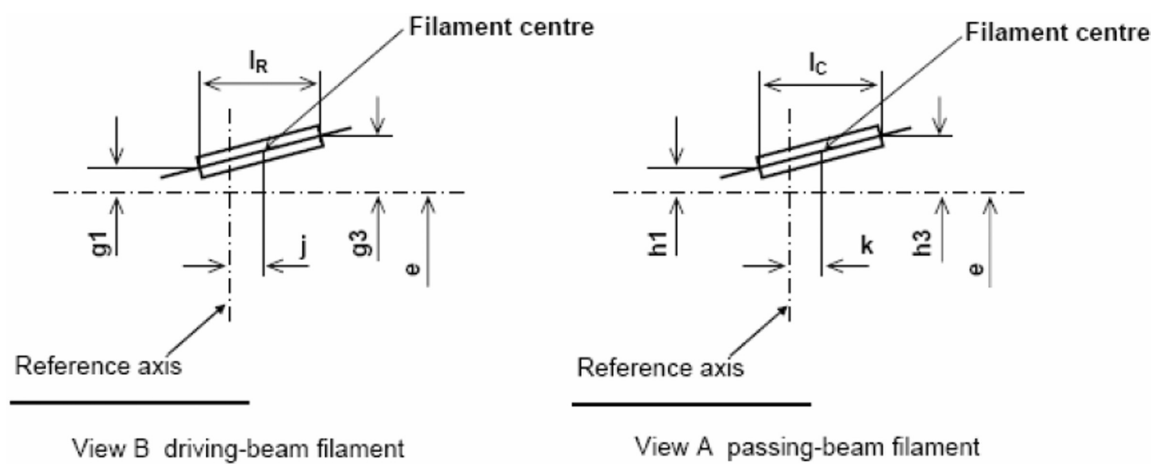
⁽⁴⁾ Glass bulb shall be optically distortion free within the angles γ_1 and γ_2 . This requirement applies to the whole bulb circumference within the angles γ_1 and γ_2 .

⁽⁵⁾ The obscuration shall extend at least to angle γ_3 and shall extend at least to the cylindrical part of the bulb on the whole top circumference.

CATEGORY HS5A — Sheet HS5A/2

Figure 3

Filament position and dimensions



Top view of driving-beam and passing-beam filament

CATEGORY HS5A — Sheet HS5A/3

Dimensions in mm		Filament lamps of normal Production	Standard filament lamp
		12 V	12 V
e	26	—	—
$l_C^{(6)}$	4,6	$\pm 0,5$	$\pm 0,3$
k	0	$\pm 0,4$	$\pm 0,2$
h1, h3	0	$\pm 0,3$	$\pm 0,15$
h2, h4	0	$\pm 0,4$	$\pm 0,2$
$l_R^{(6)}$	4,6	$\pm 0,5$	$\pm 0,3$
j	0	$\pm 0,6$	$\pm 0,3$
g1, g3	0	$\pm 0,6$	$\pm 0,3$
g2, g4	2,5	$\pm 0,4$	$\pm 0,2$
γ_1	50° min.	—	—
γ_2	23° min.	—	—
γ_3	50° min.	—	—

Cap PX23t in accordance with IEC Publication 60061 (sheet 7004-138A-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Voltage	V	12 ⁽⁷⁾		12 ⁽⁷⁾	
	Wattage	W	45	40	45	40
Test voltage		V	13,2		13,2	
Objective Values	Wattage	W	50 max.	45 max.	50 max.	45 max.
	Luminous flux	lm	750	640		
		± %	15	15		
Reference luminous at approximately			12 V		550 lm	470 lm
			13,2 V		750 lm	640 lm

⁽⁶⁾ The positions of the first and the last turn of the filament are defined by the intersections of the outside of the first and the outside of the last light-emitting turn, respectively, with the plane parallel to and 26 mm distant from the reference plane.

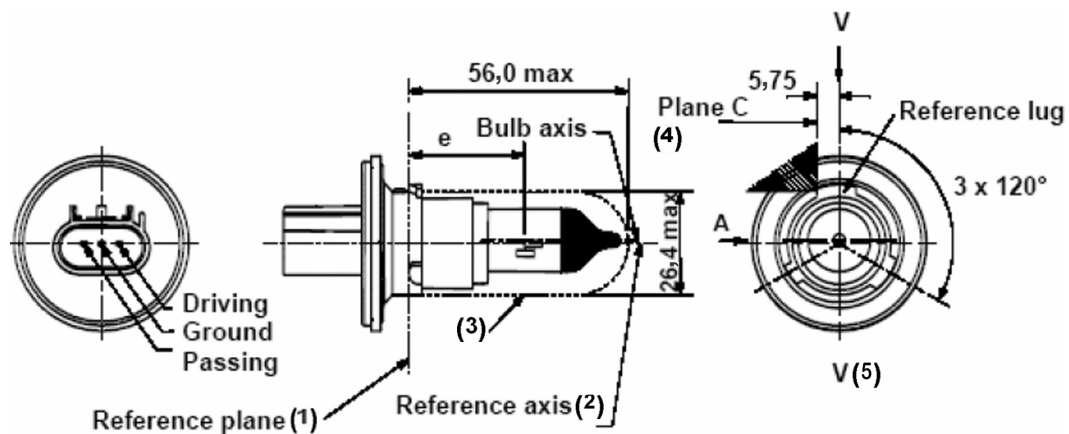
⁽⁷⁾ The values indicated in the left-hand columns relate to the driving-beam filament and those indicated in the right-hand columns to the passing-beam filament.

CATEGORY HS6 — Sheet HS6/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

Figure 1

Main drawings



(¹) The reference plane is the plane formed by the underside of the three radiused tabs of the cap.

(²) The reference axis is perpendicular to the reference plane and crosses the intersection of the two perpendiculars as indicated in Figure 2 on sheet HS6/2.

(³) Glass bulb and supports shall not exceed the envelope as indicated. The envelope is concentric to the reference axis.

(⁴) The filament lamp shall be rotated in the measuring holder until the reference lug contacts plane C of the holder.

(⁵) Plane V-V is the plane perpendicular to the reference plane passing through the reference axis and parallel to plane C.

CATEGORY HS6 — Sheet HS6/2

Figure 2

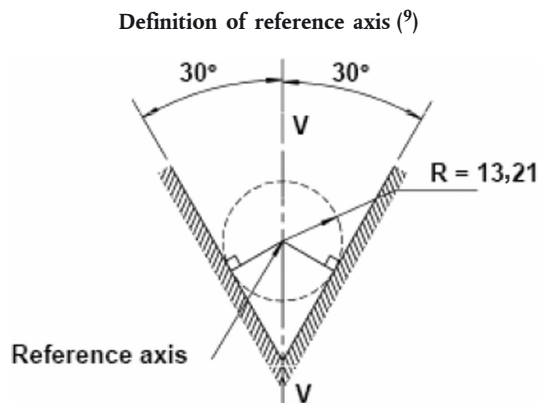


Figure 4

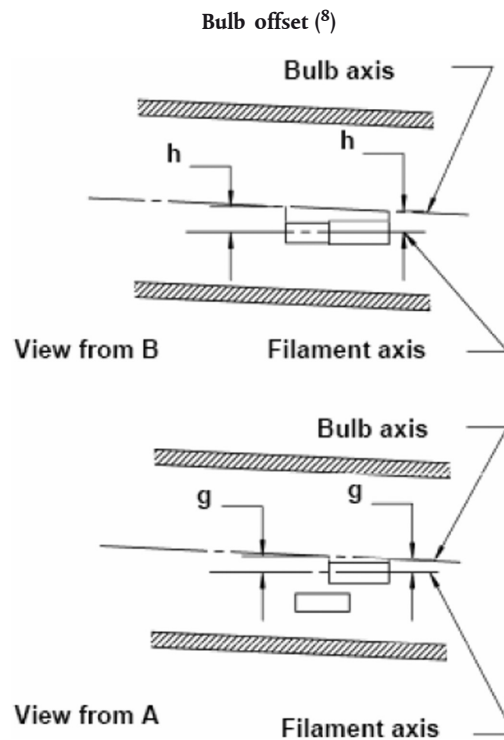


Figure 3

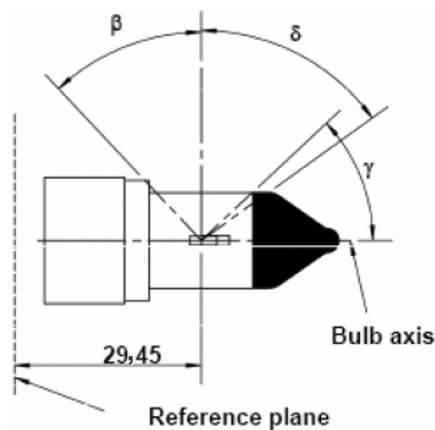
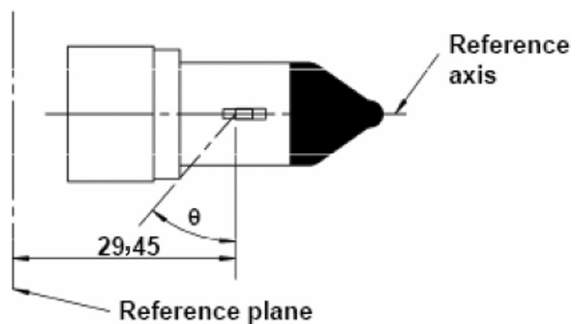
Undistorted area ⁽⁶⁾ and opaque coating ⁽⁷⁾

Figure 5

Light blocking toward cap ⁽⁹⁾

⁽⁶⁾ Glass bulb shall be optically distortion-free axially and cylindrically within the angles β and δ . This requirement applies to the whole bulb circumference within the angles and does not need to be verified in the area covered by the opaque coating.

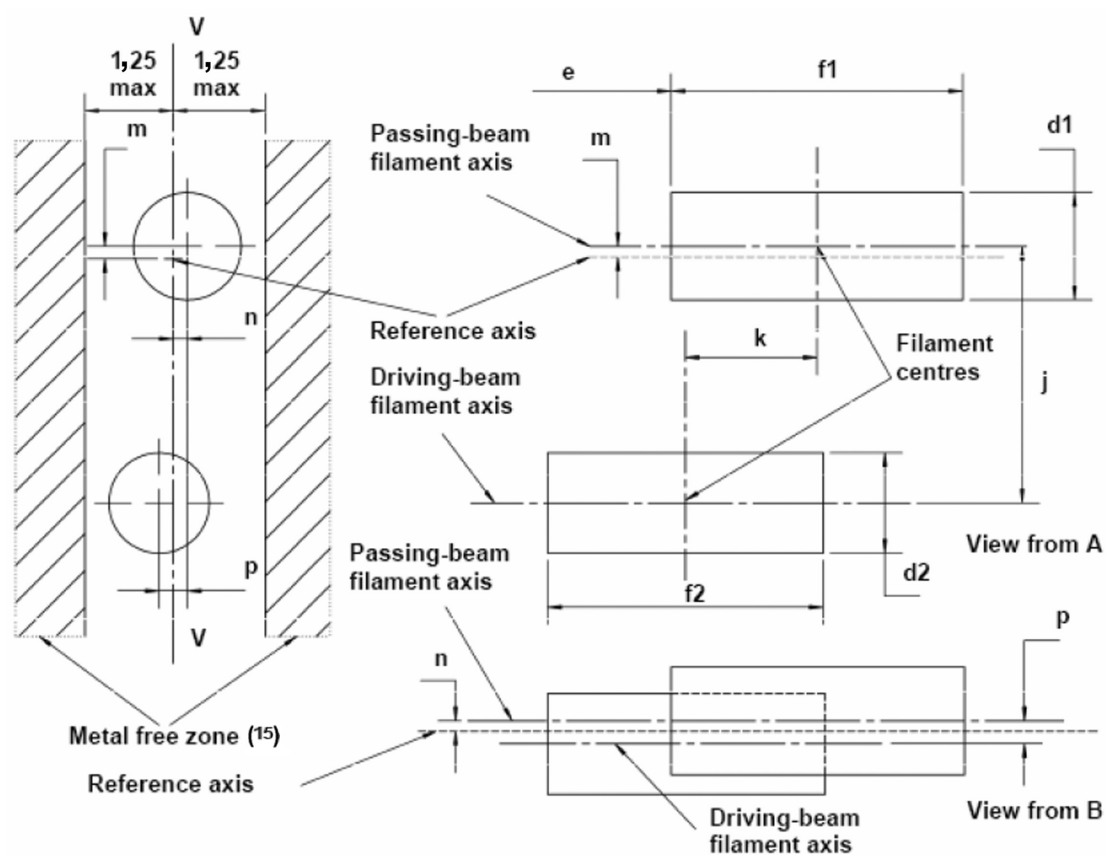
⁽⁷⁾ The opaque coating shall extend at least to the cylindrical part of the bulb on the whole bulb top circumference. It shall moreover extend at least to a plane parallel to the reference plane where crosses the outer bulb surface as shown in Figure 3 (view in direction B as indicated on sheet HS6/1).

⁽⁸⁾ Offset of passing-beam filament in relation to the bulb axis is measured in two planes parallel to the reference plane where the projection of the outside end turns nearest to and farthest from the reference plane crosses the passing-beam filament axis.

⁽⁹⁾ Light shall be blocked over the cap end of the bulb extending to angle ϑ . This requirement applies in all directions around the reference axis.

CATEGORY HS6 — Sheet HS6/3

Figure 6

Position and dimensions of filaments ⁽¹⁰⁾ ⁽¹¹⁾ ⁽¹²⁾ ⁽¹³⁾ ⁽¹⁴⁾

⁽¹⁰⁾ Dimensions j , k and p are measured from the centre of the passing-beam filament to the centre of the driving-beam filament.

⁽¹¹⁾ Dimensions m and n are measured from the reference axis to the centre of the passing-beam filament.

⁽¹²⁾ Both filaments axis are to be held within a 2° tilt with respect to the reference axis about the centre of the respective filament.

⁽¹³⁾ Note concerning the filament diameters: for the same manufacturer, the design filament diameter of standard (étalon) filament lamp and filament lamp of normal production shall be the same.

⁽¹⁴⁾ For both the driving-beam and the passing-beam filament distortion shall not exceed ± 5 per cent of filament diameter from a cylinder.

⁽¹⁵⁾ The metal free zone limits the location of lead wires within the optical path. No metal parts shall be located in the shaded area as seen in Figure 6.

CATEGORY HS6 — Sheet HS6/4

Dimensions in mm		Tolerance	
		Filaments lamps of normal production	Standard filament lamp
d1 ⁽¹³⁾ ⁽¹⁷⁾	1,4 max.	—	—
d2 ⁽¹³⁾ ⁽¹⁷⁾	1,4 max.	—	—
e ⁽¹⁶⁾	29,45	± 0,20	± 0,10
f1 ⁽¹⁶⁾	4,4	± 0,50	± 0,25
f2 ⁽¹⁶⁾	4,4	± 0,50	± 0,25
g ⁽⁸⁾ ⁽¹⁷⁾	0,5 d1	± 0,50	± 0,30
h ⁽⁸⁾	0	± 0,40	± 0,20
j ⁽¹⁰⁾	2,5	± 0,30	± 0,20
k ⁽¹⁰⁾	2,0	± 0,20	± 0,10
m ⁽¹¹⁾	0	± 0,24	± 0,20
n ⁽¹¹⁾	0	± 0,24	± 0,20
p ⁽¹⁰⁾	0	± 0,30	± 0,20
β	42° min.	—	—
δ	52° min.	—	—
γ	43°	+ 0° / - 5°	+ 0° / - 5°
⁽⁹⁾	41°	± 4°	± 4°

Cap: PX26,4t in accordance with IEC Publication 60061 (sheet 7004-128-3)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS ⁽¹⁸⁾

Rated values	Volts	12		12	
	Watts	40	35	40	35
Test voltage	Volts	13,2		13,2	
Objective values	Watts	45 max.	40 max.	45 max.	40 max.
	Luminous flux	900 ± 15 %	600 ± 15 %		
Reference luminous flux at approximately		12 V		630 / 420	
		13,2 V		900 / 600	

⁽¹⁶⁾ The ends of the filament are defined as the points where, when the viewing direction is direction A as shown on sheet HS6/1, the projection of the outside of the end turns crosses the filament axis.

⁽¹⁷⁾ d1 is the actual diameter of the passing-beam filament.

d2 is the actual diameter of the driving-beam filament.

⁽¹⁸⁾ The values indicated in the left-hand columns relate to the driving-beam filament and those in the right-hand columns to the passing-beam filament.

CATEGORY P13W — Sheet P13W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

Figure 1

Main drawing

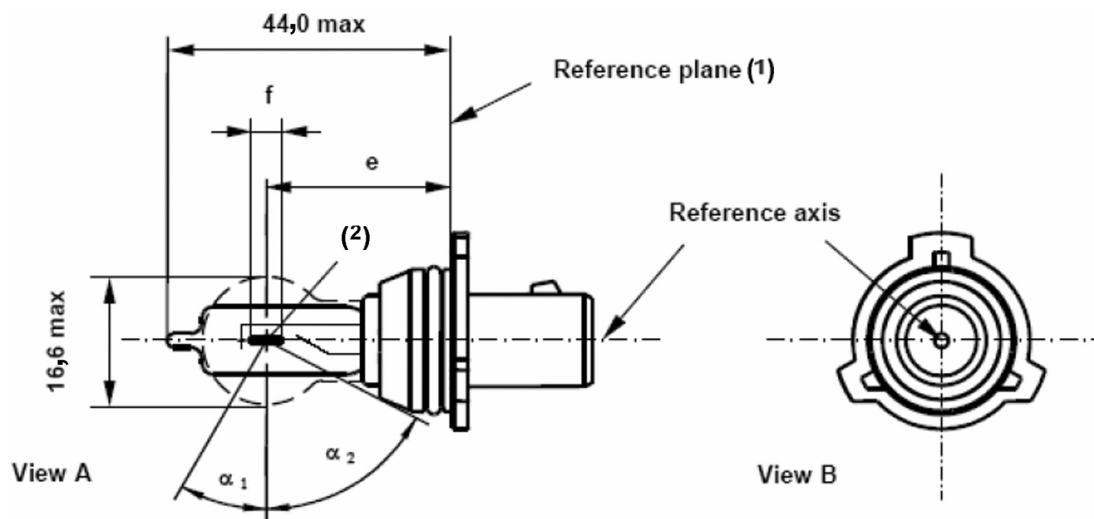
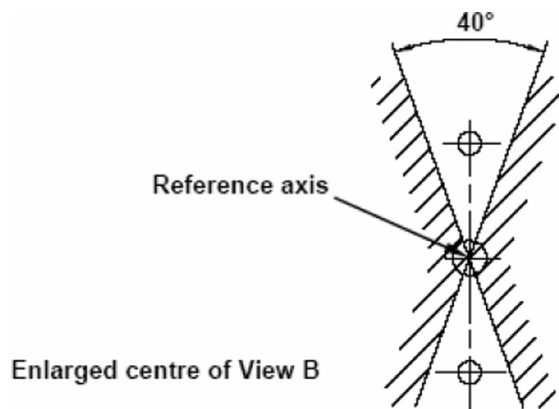


Figure 2

Metal free zone ⁽³⁾

⁽¹⁾ The reference plane is defined by the meeting points of the cap-holder fit.

⁽²⁾ No actual filament diameter restrictions apply but the objective is $d_{\text{max.}} = 1,0 \text{ mm}$.

⁽³⁾ No opaque parts other than filament turns shall be located in the shaded area indicated in Figure 2. This applies to the rotational body within the angles $\alpha_1 + \alpha_2$.

CATEGORY P13W — Sheet P13W/2

Dimensions in mm	Filament lamps of normal production	Standard filament lamp
e ⁽⁵⁾	25,0 ⁽⁴⁾	25,0 ± 0,25
f ⁽⁵⁾	4,3 ⁽⁴⁾	4,3 ± 0,25
α ₁ ⁽⁶⁾	30,0° min.	30,0° min.
α ₂ ⁽⁶⁾	58,0° min.	58,0° min.

Cap PG18.5d-1 in accordance with IEC Publication 60061 (sheet 7004-147-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Voltage	V	12	12
	Wattage	W	13	13
Test voltage		V	13,5	13,5
Objective values	Wattage	W	19 max.	19 max.
	Luminous flux	lm	250	
		±	+ 15 % / – 20 %	
Reference luminous flux at approximately 13,5 V				250 lm

⁽⁴⁾ To be checked by means of a 'Box-System'; sheet P13W/3.

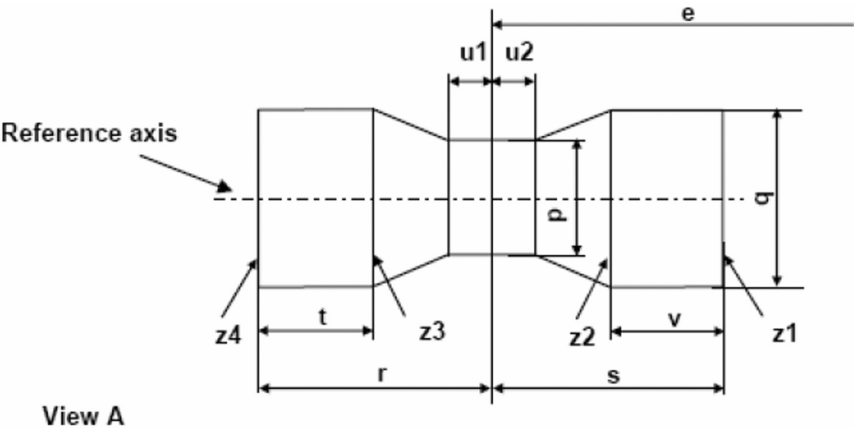
⁽⁵⁾ The ends of the filament are defined as the points where, when the viewing direction is perpendicular to the plane through the filament lead-in wires, the projection of the outside of the end turns crosses the filament axis.

⁽⁶⁾ No part of the cap beyond the reference plane shall interfere with angle α₂ as shown in Figure 1 on sheet P13W/1. The bulb shall be optically distortion free within the angles α₁ + α₂. These requirements apply to the whole bulb circumference.

CATEGORY P13W — Sheet P13W/3

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



	p	q	u1, u2	r, s	t, v
Filament lamps of normal production	1,7	1,9	0,3	2,6	0,9
Standard filament lamps	1,5	1,7	0,25	2,45	0,6

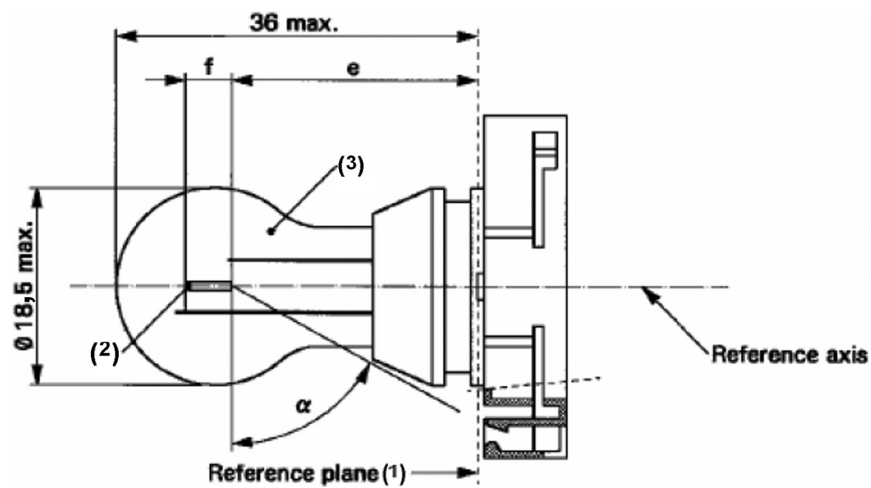
The filament position is checked in two mutually perpendicular planes, one of them being the plane through the lead-in wires.

The ends of the filament as defined on sheet P13W/2, note 4, shall lie between Z1 and Z2 and between the lines Z3 and Z4.

The filament shall lie entirely within the limits shown.

CATEGORIES P19W, PY19W, PR19W, PS19W, PSY19W AND PSR19W — Sheet P19W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



⁽¹⁾ The reference plane is defined by the meeting points of the cap-holder fit.

⁽²⁾ No actual filament diameter restrictions apply but the objective is $d_{max} = 1,1$ mm.

⁽³⁾ The light emitted from normal production lamps shall be white for categories P19W and PS19W; amber for categories PY19W and PSY19W; red for categories PR19W and PSR19W (see also note 8).

CATEGORIES P19W, PY19W, PR19W, PS19W, PSY19W AND PSR19W — Sheet P19W/2

Dimensions in mm ⁽⁴⁾	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	α ⁽⁸⁾
e ⁽⁵⁾ ⁽⁶⁾		24,0		24,0
f ⁽⁵⁾ ⁽⁶⁾		4,0		4,0 ± 0,2
α ⁽⁷⁾	58°			58° min.
P19W Cap PGU20-1 PY19W Cap PGU20-2 PR19W Cap PGU20-5 PS19W Cap PG20-1 PSY19W Cap PG20-2 PSR19W Cap PG20-5	in accordance with IEC Publication 60061 (sheet 7004-127-2)			

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts		12	12
	Watts		19	19
Test voltage	Volts		13,5	13,5
Objective values	Watts		20 max.	20 max.
	Luminous flux	P19W PS19W	350 ± 15 %	
		PY19W PSY19W	215 ± 20 %	
		PR19W PSR19W	80 ± 20 %	
Reference luminous flux at approximately 13,5 V			White: 350 lm Amber: 215 lm Red: 80 lm	

⁽⁴⁾ For categories PS19W, PSY19W and PSR19W, dimensions may be checked with O-ring removed to assure the correct mounting during testing.

⁽⁵⁾ The filament position is checked by means of a 'Box-System'; sheet P19W/3.

⁽⁶⁾ The ends of the filament are defined as the points where, when the viewing direction is perpendicular to the plane through the filament lead-in wires as showed in the drawing on sheet P19W/1, the projection of the outside of the end turns crosses the filament axis.

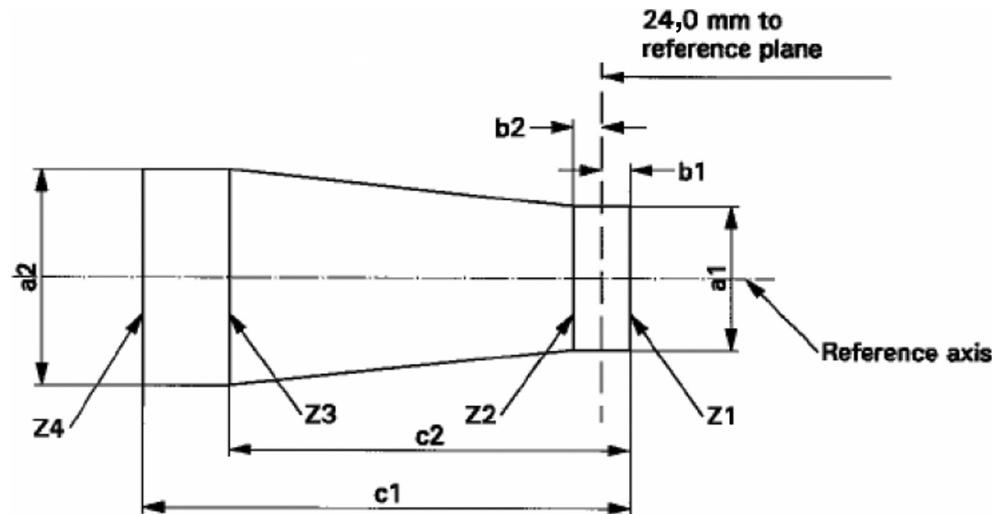
⁽⁷⁾ No part of the cap beyond the reference plane shall interfere with angle α . The bulb shall be optically distortion free within the angle $2\alpha \pm 180^\circ$.

⁽⁸⁾ The light emitted from standard filament lamps shall be white for categories P19W and PS19W; white or amber for categories PY19W and PSY19W; white or red for categories PR19W and PSR19W.

CATEGORIES P19W, PY19W, PR19W, PS19W, PSY19W AND PSR19W — Sheet P19W/3

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



	a1	a2	b1, b2	c1	c2
Filament lamps of normal production	2,9	3,9	0,5	5,2	3,8
Standard filament lamps	1,5	1,7	0,25	4,7	3,8

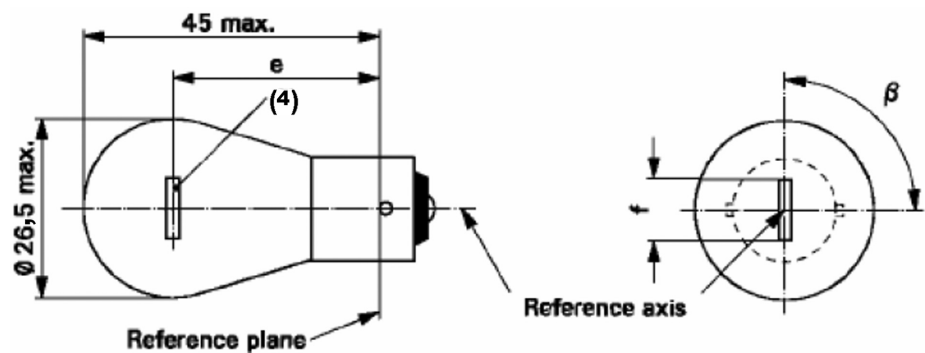
The filament position is checked in two mutually perpendicular planes, one of them being the plane through the lead-in wires.

The ends of the filament as defined on sheet P19W/2, note 6, shall lie between Z1 and Z2 and between the lines Z3 and Z4.

The filament shall lie entirely within the limits shown.

CATEGORY P21W — Sheet P21W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm		Filament lamps of normal production			Standard filament lamp
		min.	nom.	max.	
e	6,12 V		31,8 ⁽³⁾		31,8 ± 0,3
	24 V	30,8	31,8	32,8	
f	12 V	5,5	6,0	7,0	6,0 ± 0,5
	6 V			7,0	
Lateral deviation ⁽¹⁾	6,12 V			⁽³⁾	0,3 max.
	24 V			1,5	
β		75°	90°	105°	90° ± 5°

Cap BA15s in accordance with IEC Publication 60061 (sheet 7004-11A-9) ⁽²⁾

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	6	12	24	12
	Watts	21			21
Test voltage	Volts	6,75	13,5	28,0	13,5
Objective values	Watts	27,6 max.	26,5 max.	29,7 max.	26,5 max.
	Luminous flux	460 ± 15 %			

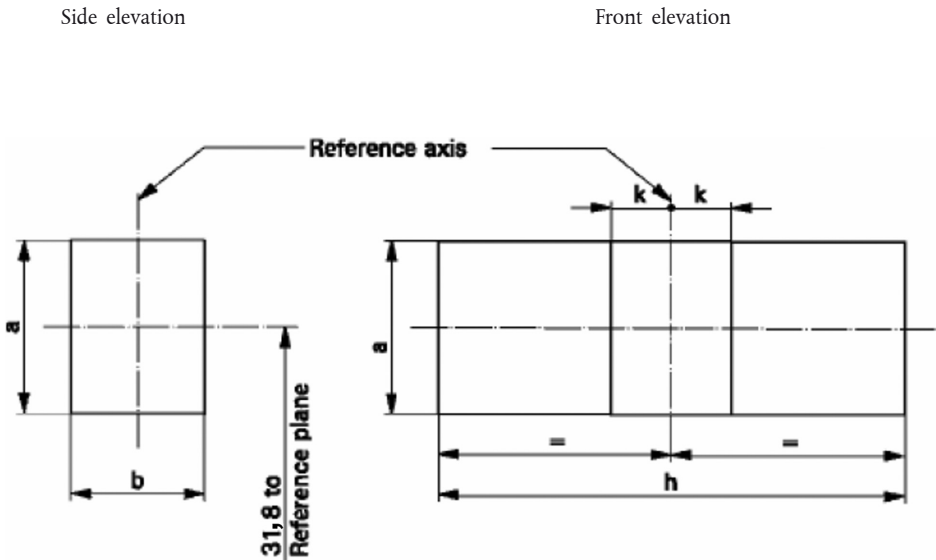
Reference luminous flux: 460 lm at approximately 13,5 V

⁽¹⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis of the pins.
⁽²⁾ Filament lamps with cap BA15d may be used for special purposes; they have the same dimensions.
⁽³⁾ To be checked by means of a 'Box-System'; sheet P21W/2.
⁽⁴⁾ In this view the filament of the 24 V type may be straight or V-shaped. This shall be indicated in the application of approval. If it is straight, the screen projection requirements, sheet P21W/2, apply. If it is V-shaped, the filament ends shall be at the same distance within ± 3 mm from the reference plane.

CATEGORY P21W — Sheet P21W/2

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane and has an axis perpendicular, within $\pm 15^\circ$, to the plane through the centre line of the pins (P21W) or of the reference pin (PY21W and PR21W) and the reference axis, whether a filament lamp complies with the requirements.



Reference	a	b	h	k
Dimension	3,5	3,0	9,0	1,0

Test procedures and requirements

- The filament lamp is placed in a holder capable of being rotated about its axis and having either a calibrated scale or fixed stops corresponding to the angular displacement tolerance limits. The holder is then so rotated that an end view of the filament is seen on the screen on to which the image of the filament is projected. The end view of the filament shall be obtained within the angular displacements tolerance limits.
- Side elevation

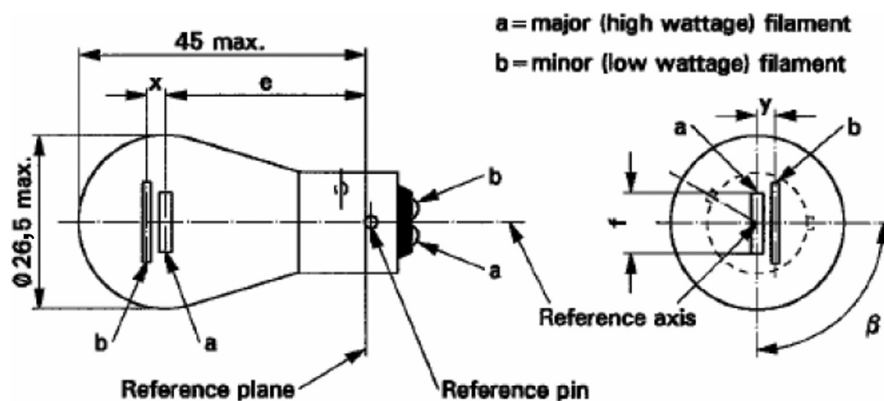
The filament lamp placed with the cap down, the reference axis vertical and the filament seen end-on, the projection of the filament shall lie entirely within a rectangle of height 'a' and width 'b', having its centre at the theoretical position of the centre of the filament.
- Front elevation

The filament lamp placed with the cap down and the reference axis vertical, the filament lamp being viewed in a direction at right angles to the filament axis:

 - The projection of the filament shall lie entirely within a rectangle of height 'a' and width 'h', having its centre at the theoretical position of the centre of the filament.
 - The centre of the filament shall not be offset by more than distance 'k' from the reference axis.

CATEGORY P21/4W — Sheet P21/4W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e		31,8 ⁽¹⁾		31,8 ± 0,3
f			7,0	7,0 + 0 / - 2
Lateral deviation			⁽¹⁾	0,3 max. ⁽²⁾
x, y	⁽¹⁾			2,8 ± 0,5
β	75° ⁽¹⁾	90° ⁽¹⁾	105° ⁽¹⁾	90° ± 5°

Cap BAZ15d in accordance with IEC Publication 60061 (sheet 7004-11C-3)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12		24		12
	Watts	21	4	21	4	21 / 4
Test voltage	Volts	13,5		28,0		13,5
Objective values	Watts	26,5 max.	5,5 max.	29,7 max.	8,8 max.	26,5 / 5,5 max.
	Luminous flux ± %	440	15	440	20	
		15	20	15	20	

Reference luminous flux: 440 lm and 15 lm at approximately 13,5 V

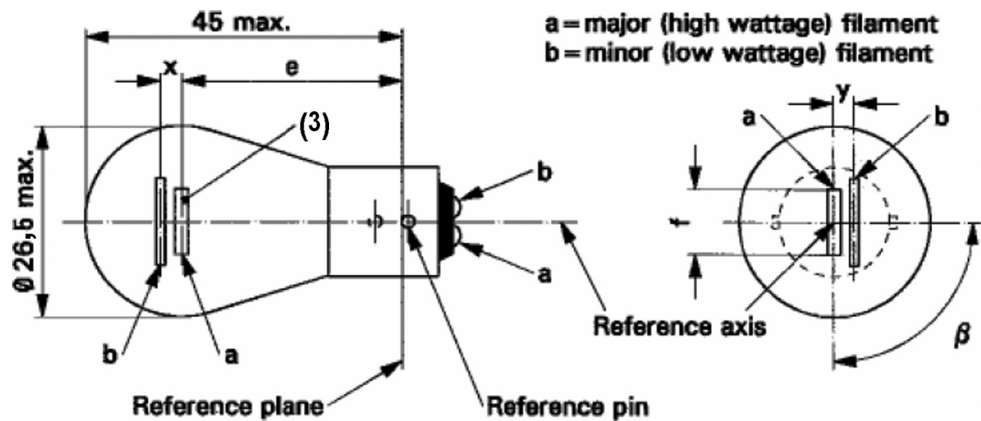
⁽¹⁾ These dimensions shall be checked by means of a 'Box-System' ³ based on the dimensions and tolerances shown above. 'x' and 'y' refer to the major (high-wattage) filament, not to the reference axis. Means of increasing the positioning accuracy of the filament and of the cap-holder assembly are under consideration.

⁽²⁾ Maximum lateral deviation of the major filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis of the reference pin.

⁽³⁾ The 'Box-System' is the same as for filament lamp P21/5W.

CATEGORY P21/5W — Sheet P21/5W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm		Filament lamps of normal production			Standard filament lamp
		min.	nom.	max.	
e	6,12 V		31,8 ⁽¹⁾		31,8 ± 0,3
	24 V	30,8	31,8	32,8	
f	6,12 V			7,0	7,0 + 0 / - 2
Lateral deviation ⁽²⁾	6,12 V			⁽¹⁾	0,3 max.
	24 V			1,5	
x, y	6,12 V		⁽¹⁾		2,8 ± 0,3
x	24 V ⁽³⁾	- 1,0	0	1,0	
y	24 V ⁽³⁾	1,8	2,8	3,8	
β		75°	90°	105°	90° ± 5°

Cap BAY15d in accordance with IEC Publication 60061 (sheet 7004-11B-7)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	6		12		24		12
	Watts	21	5	21	5	21	5	21 / 5
Test voltage	Volts	6,75		13,5		28,0		13,5
Objective values	Watts	27,6 max.	6,6 max.	26,5 max.	6,6 max.	29,7 max.	11,0 max.	26,5 and 6,6 max.
	Luminous flux ± %	440	35	440	35	440	40	
		15	20	15	20	15	20	

Reference luminous flux: 440 and 35 lm at approximately 13,5 V

For the notes see sheet P21/5W/2.

CATEGORY P21/5W — Sheet P21/5W/2*Notes:*

- (¹) These dimensions shall be checked by means of a 'box-system'. See sheets P21/5W/2 and P21/5W/3. 'x' and 'y' refer to the major (high-wattage) filament, not to the reference axis.
- (²) Maximum lateral deviation of the major (high wattage) filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis of the reference pin.
- (³) In this view the filaments of the 24 V type may be straight or V-shaped. This shall be indicated in the application of approval. If the filaments are straight, the screen projection requirements apply. If they are V-shaped, the ends of each filament shall be at the same distance within ± 3 mm from the reference plane.

Screen projection requirements

This test is used to determine, by checking whether:

- (a) the major (high wattage) filament is correctly positioned relative to the reference axis and reference plane and has an axis perpendicular, within $\pm 15^\circ$, to the plane through the centres of the pins and the reference axis; and whether
- (b) the minor (low wattage) filament is correctly positioned relative to the major (high wattage) filament, whether a filament lamp complies with the requirements.

Test procedure and requirements

1. The filament lamp is placed in a holder capable of being rotated about its axis and having either a calibrated scale or fixed stops corresponding to the angular displacement tolerance limits. (i.e. 15°). The holder is then so rotated that an end view of the major filament is seen on the screen on which the image of the filament is projected. The end view of that filament shall be obtained within the angular displacement tolerance limits.
2. Side elevation

The filament lamp placed with the cap down, the reference axis vertical, the reference pin to the right and the major filament seen end-on:

 - 2.1. the projection of the major filament shall lie entirely within a rectangle of height 'a' and width 'b', having its centre at the theoretical position of the centre of the filament;
 - 2.2. the projection of the minor filament shall lie entirely:
 - 2.2.1. within a rectangle of width 'c' and height 'd' having its centre at a distance 'v' to the right of and at a distance 'u' above the theoretical position of the centre of the major filament;
 - 2.2.2. above a straight line tangential to the upper edge of the projection of the major filament and rising from left to right at an angle of 25° .
 - 2.2.3. to the right of the projection of the major filament.
3. Front elevation

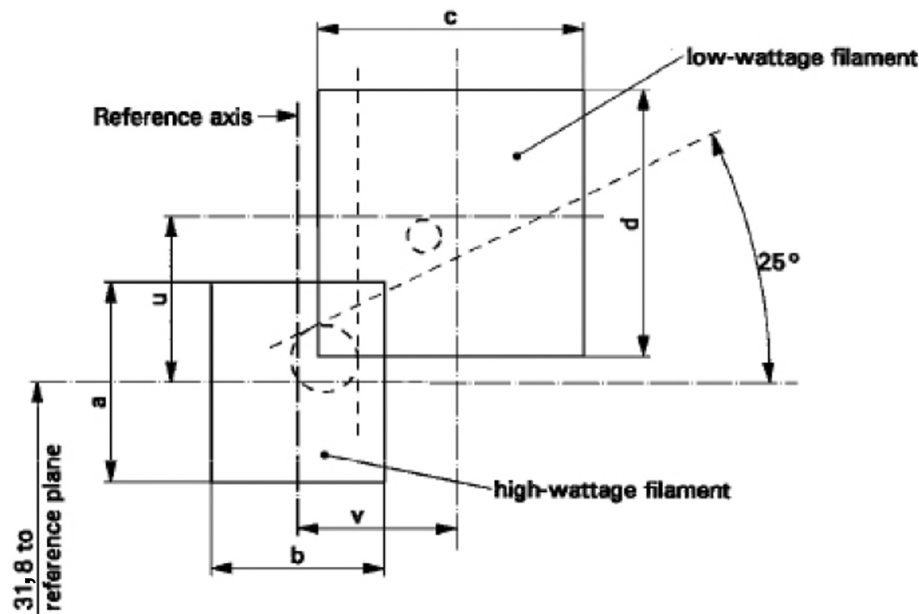
The filament lamp being placed with the cap down and the reference axis vertical, the filament lamp being viewed in a direction at right angles to axis of the major filament:

 - 3.1. the projection of the major filament shall lie entirely within a rectangle of height 'a' and width 'h', centred on the theoretical position of the centre of the filament;
 - 3.2. the centre of the major filament shall not be offset by more than distance 'k' from the reference axis.
 - 3.3. the centre of the minor filament axis shall not be offset from the reference axis by more than ± 2 mm ($\pm 0,4$ mm for standard filament lamps).

CATEGORY P21/5W — Sheet P21/5W/3

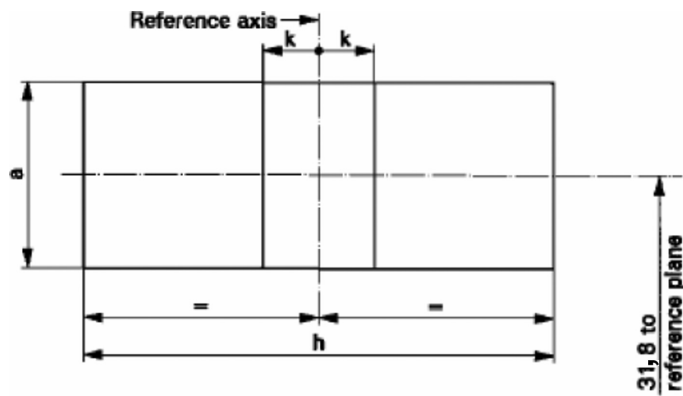
(Dimensions in mm)

Side elevation



Reference	a	b	c	d	u	v
Dimension	3,5	3,0	4,8		2,8	

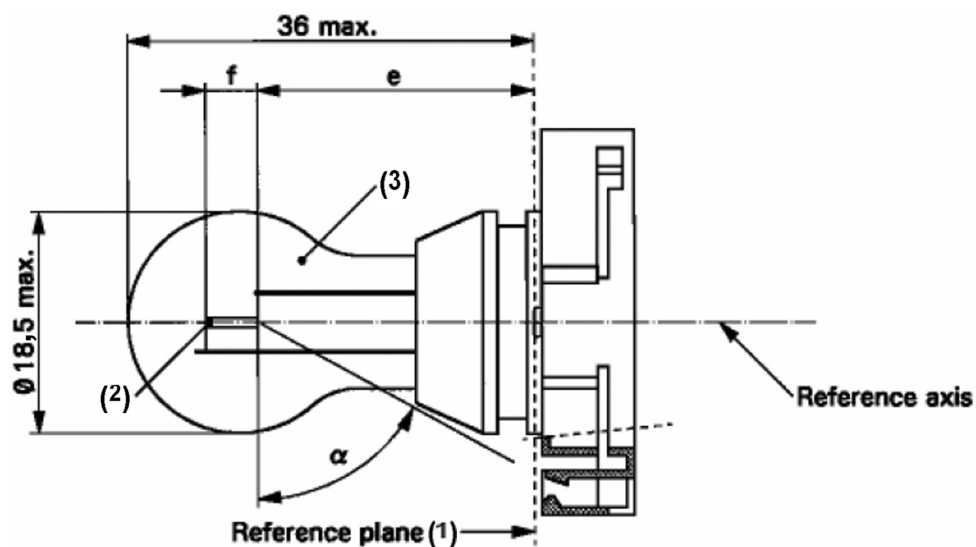
Front elevation



Reference	a	h	k
Dimension	3,5	9,0	1,0

CATEGORIES P24W, PX24W, PY24W, PR24W, PS24W, PSX24W, PSY24W and PSR24W — Sheet P24W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



⁽¹⁾ The reference plane is defined by the meeting points of the cap-holder fit.

⁽²⁾ No actual filament diameter restrictions apply but the objective is $d_{\text{max.}} = 1,1 \text{ mm}$.

⁽³⁾ The light emitted from normal production lamps shall be white for categories P24W, PX24W, PS24W and PSX24W; amber for categories PY24W and PSY24W; red for the categories PR24W and PSR24W. (See also note 8)

CATEGORIES P24W, PX24W, PY24W, PR24W, PS24W, PSX24W, PSY24W and PSR24W — Sheet P24W/2

Dimensions in mm ⁽⁴⁾		Filament lamps of normal production			Standard filament lamp
		min.	nom.	max.	⁽⁸⁾
e ⁽⁵⁾ ⁽⁶⁾			24,0		24,0
f ⁽⁵⁾ ⁽⁶⁾	P24W, PY24W, PR24W, PS24W, PSY24W, PSR24W		4,0		4,0
	PX24W, PSX24W		4,2		4,2
α ⁽⁷⁾		58,0°			58,0° min.
P24W	Cap PGU20-3	in accordance with IEC Publication 60061 (sheet 7004-127-2)			
PX24W	Cap PGU20-7				
PY24W	Cap PGU20-4				
PR24W	Cap PGU20-6				
PS24W	Cap PG20-3				
PSX24W	Cap PG20-7				
PSY24W	Cap PG20-4				
PSR24W	Cap PG20-6				

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts		12	12
	Watts		24	24
Test voltage	Volts		13,5	13,5
Objective values	Watts		25 max.	25 max.
	Luminous flux	P24W PS24W	500 + 10 / – 20 %	
		PX24W PSX24W	500 + 10 / – 15 %	
		PY24W PSY24W	300 + 15 / – 25 %	
		PR24W PSR24W	115 + 15 / – 25 %	
Reference luminous flux at approximately			12 V	White: 345 lm
			13,2 V	White: 465 lm
			13,5 V	White: 500 lm Amber: 300 lm Red: 115 lm

⁽⁴⁾ For categories PS24W, PSX24W, PSY24W and PSR24W, dimensions may be checked with O-ring removed to assure the correct mounting during testing.

⁽⁵⁾ The filament position is checked by means of a 'box-system'; sheet P24W/3.

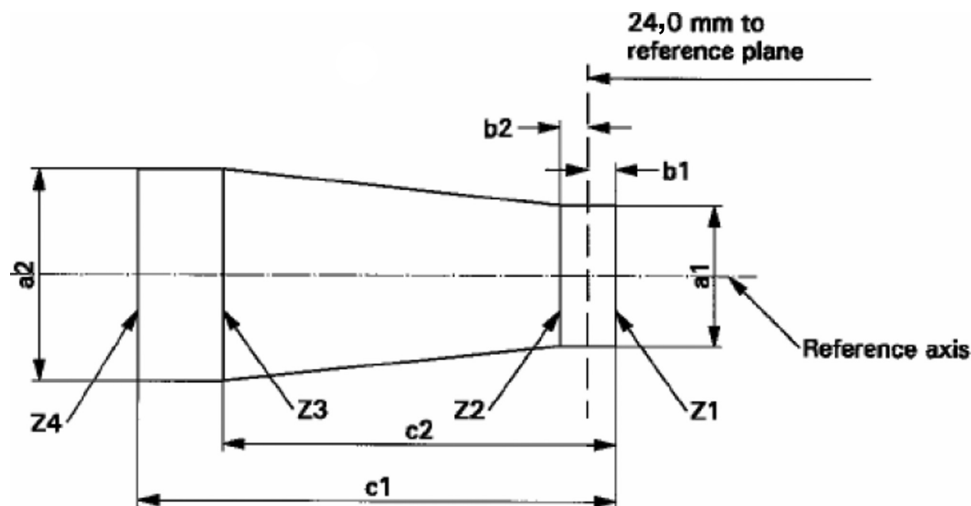
⁽⁶⁾ The ends of the filament are defined as the points where, when the viewing direction is perpendicular to the plane through the filament lead-in wires as shown in the drawing on sheet P24W/1, the projection of the outside of the end turns crosses the filament axis.

⁽⁷⁾ No part of the cap beyond the reference plane shall interfere with angle α. The bulb shall be optically distortion free within the angle 2α + 180°.

⁽⁸⁾ The light emitted from standard filament lamps shall be white for categories P24W, PX24W, PS24W and PSX24W; white or amber for categories PY24W and PSY24W; white or red for categories PR24W and PSR24W.

CATEGORIES P24W, PX24W, PY24W, PR24W, PS24W, PSX24W, PSY24W and PSR24W — Sheet P24W/3
Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



P24W, PY24W, PR24W, PS24W, PSY24W, PSR24W	a1	a2	b1, b2	c1	c2
Filament lamps of normal production	2,9	3,9	0,5	5,2	3,8
Standard filament lamps	1,5	1,7	0,25	4,7	3,8

PX24W, PSX24W	a1	a2	b1, b2	c1	c2
Filament lamps of normal production	1,9	1,9	0,35	5,0	4,0
Standard filament lamps	1,5	1,5	0,25	4,7	4,0

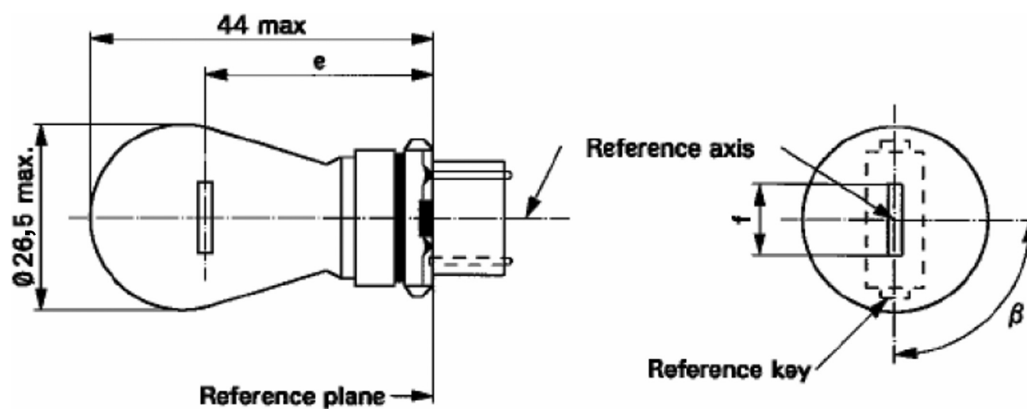
The filament position is checked in two mutually perpendicular planes, one of them being the plane through the lead-in wires.

The ends of the filament as defined on sheet P24W/2, note 6, shall lie between Z1 and Z2 and between the lines Z3 and Z4.

The filament shall lie entirely within the limits shown.

CATEGORY P27W — Sheet P27W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e		27,9 ⁽³⁾		27,9 ± 0,3
f			9,9	9,9 + 0 / - 2
Lateral deviation ⁽²⁾			⁽³⁾	0,0 ± 0,4
β	75° ⁽³⁾	90°	105° ⁽³⁾	90° ± 5°

Cap W2.5x16d in accordance with IEC Publication 60061 (sheet 7004-104-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	27	27
Test voltage	Volts	13,5	13,5
Objective values	Watts	32,1 max.	32,1 max.
	Luminous flux	475 ± 15 %	

Reference luminous flux: 475 lm at approximately 13,5 V

⁽¹⁾ The reference axis is defined with respect to the reference keys and is perpendicular to the reference plane.

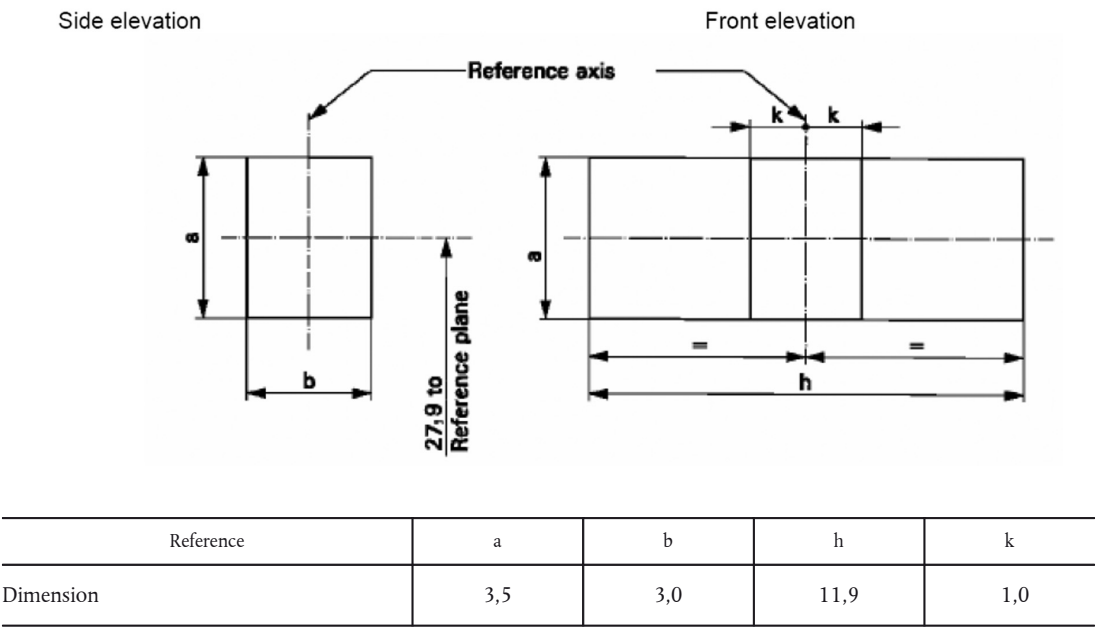
⁽²⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis through the reference keys.

⁽³⁾ To be checked by means of a 'Box System', sheet P27W/2.

CATEGORY P27W — Sheet P27W/2

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane and has an axis perpendicular, within $\pm 15^\circ$, to the plane through the centres of the keys and the reference axis, whether a filament lamp complies with the requirements.



Test procedures and requirements

- The filament lamp is placed in a holder capable of being rotated about its axis and having either a calibrated scale or fixed stops corresponding to the angular displacement tolerance limits. The holder is then so rotated that an end view of the filament is seen on the screen on to which the image of the filament is projected. The end view of the filament shall be obtained within the angular displacements tolerance limits.
- Side elevation

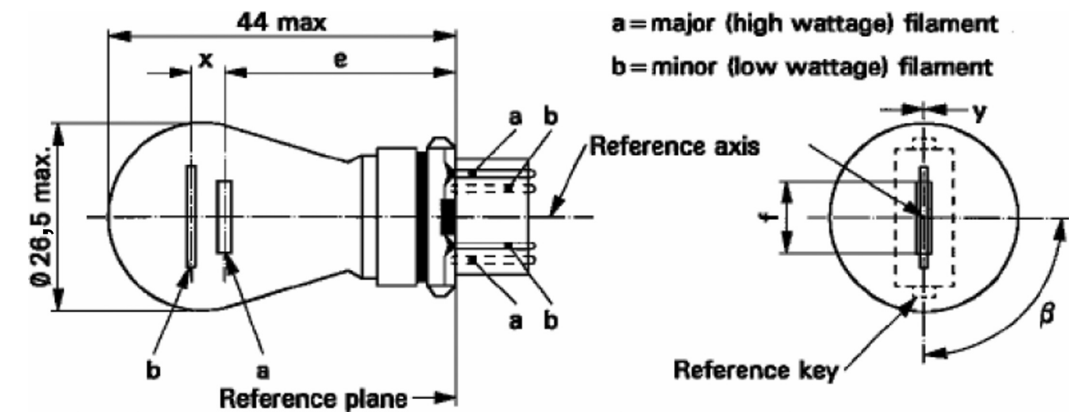
The filament lamp placed with the cap down, the reference axis vertical and the filament seen end-on, the projection of the filament shall lie entirely within a rectangle of height 'a' and width 'b', having its centre at the theoretical position of the centre of the filament.
- Front elevation

The filament lamp placed with the cap down and the reference axis vertical, the filament lamp being viewed in a direction at right angles to the filament axis:

 - The projection of the filament shall lie entirely within a rectangle of height 'a' and width 'h', having its centre at the theoretical position of the centre of the filament.
 - The centre of the filament shall not be offset by more than distance 'k' from the reference axis.

CATEGORY P27/7W — Sheet P27/7W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e		27,9 ⁽³⁾		27,9 ± 0,3
f			9,9	9,9 + 0 / - 2
Lateral deviation ⁽²⁾			⁽³⁾	0,0 ± 0,4
x ⁽⁴⁾		5,1 ⁽³⁾		5,1 ± 0,5
y ⁽⁴⁾		0,0 ⁽³⁾		0,0 ± 0,5
β	75° ⁽³⁾	90°	105° ⁽³⁾	90° ± 5°

Cap W2,5x16q in accordance with IEC Publication 60061 (sheet 7004-104-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12		12	
	Watts	27	7	27	7
Test voltage	Volts	13,5		13,5	
Objective values	Watts	32,1 max.	8,5 max.	32,1 max.	8,5 max.
	Luminous flux	475 ± 15 %	36 ± 15 %		

Reference luminous flux: 475 and 36 lm at approximately 13,5 V

- ⁽¹⁾ The reference axis is defined with respect to the reference keys and is perpendicular to the reference plane.
⁽²⁾ Maximum lateral deviation of the major (high wattage) filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis through the reference keys.
⁽³⁾ To be checked by means of a 'Box-System', sheets P27/7W/2 and 3.
⁽⁴⁾ 'x' and 'y' denote the offset of the axis of the minor (low wattage) filament with respect to the axis of the major (high wattage) filament.

CATEGORY P27/7W — Sheet P27/7W/2

Screen projection requirements

This test is used to determine, by checking whether:

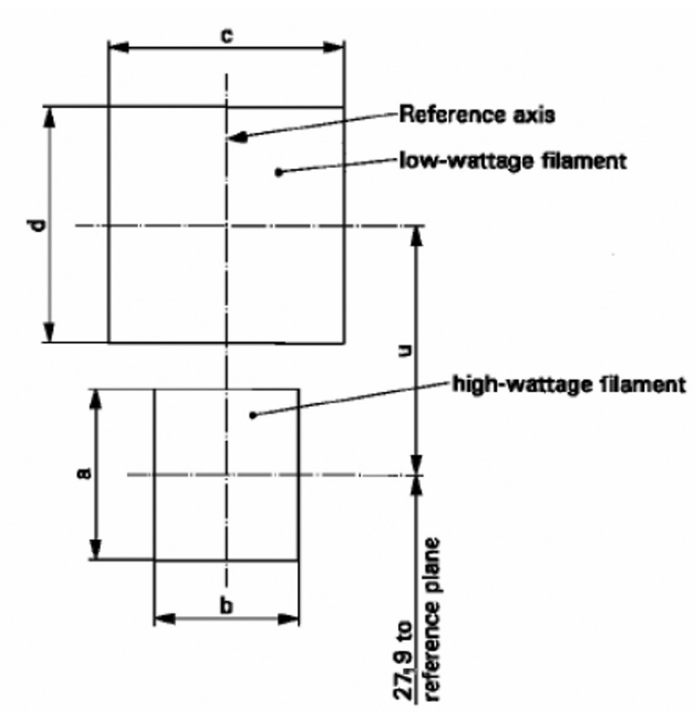
- (a) the major (high wattage) filament is correctly positioned relative to the reference axis and reference plane and has an axis perpendicular, within $\pm 15^\circ$, to the plane through the centres of the keys and the reference axis; and whether:
- (b) the minor (low wattage) filament is correctly positioned relative to the major (high wattage) filament, whether a filament lamp complies with the requirements.

Test procedure and requirements

1. The filament lamp is placed in a holder capable of being rotated about its axis and having either a calibrated scale or fixed stops corresponding to the angular displacement tolerance limits. The holder is then so rotated that an end view of the major filament is seen on the screen on which the image of the filament is projected. The end view of that filament shall be obtained within the angular displacement tolerance limits.
2. Side elevation
The filament lamp placed with the cap down, the reference axis vertical, the reference key to the right and the major filament seen end-on:
 - 2.1. the projection of the major filament shall lie entirely within a rectangle of height 'a' and width 'b', having its centre at the theoretical position of the centre of the filament;
 - 2.2. the projection of the minor filament shall lie entirely within a rectangle of width 'c' and height 'd' having its centre at a distance 'u' above the theoretical position of the centre of the major filament.
3. Front elevation
The filament lamp being placed with the cap down and the reference axis vertical, the filament lamp being viewed in a direction at right angles to axis of the major filament:
 - 3.1. the projection of the major filament shall lie entirely within a rectangle of height 'a' and width 'h', centred on the theoretical position of the centre of the filament;
 - 3.2. the centre of the major filament shall not be offset by more than distance 'k' from the reference axis;
 - 3.3. the centre of the minor filament axis shall not be offset from the reference axis by more than ± 2 mm ($\pm 0,4$ mm for standard filament lamps).

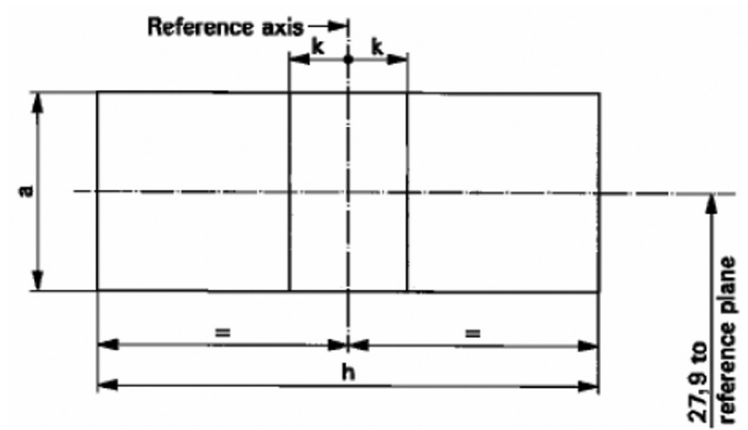
CATEGORY P27/7W — Sheet P27/7W/3

Side elevation



Reference	a	b	c	d	u
Dimensions	3,5	3,0	4,8		5,1

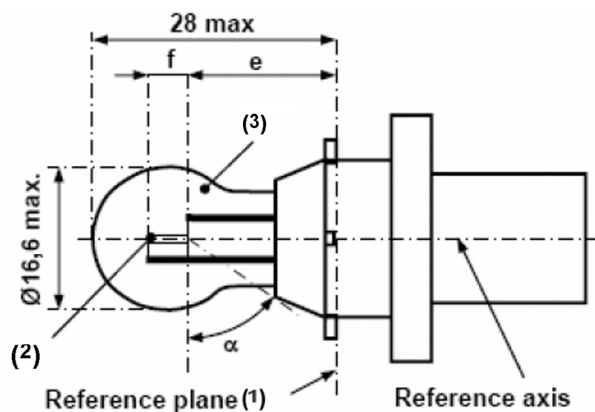
Front elevation



Reference	a	h	k
Dimensions	3,5	11,9	1,0

CATEGORIES PC16W, PCY16W AND PCR16W — Sheet PC16W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



⁽¹⁾ The reference plane is defined by the meeting points of the cap-holder fit.

⁽²⁾ No actual filament diameter restrictions apply but the objective is $d_{\text{max.}} = 1,1 \text{ mm}$.

⁽³⁾ The light emitted from normal production lamps shall be white for category PC16W; amber for category PCY16W; red for category PCR16W (see also note 7).

CATEGORIES PC16W, PCY16W AND PCR16W — Sheet PC16W/2

Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	(⁷)
e (⁴) (⁵)		18,5		18,5
f (⁴) (⁵)		4,0		4,0 ± 0,2
α (⁶)	54°			54° min.

PC16W Cap PU20d-1

PCY16W Cap PU20d-2

PCR16W Cap PU20d-7

in accordance with IEC Publication 60061 (sheet 7004-157-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

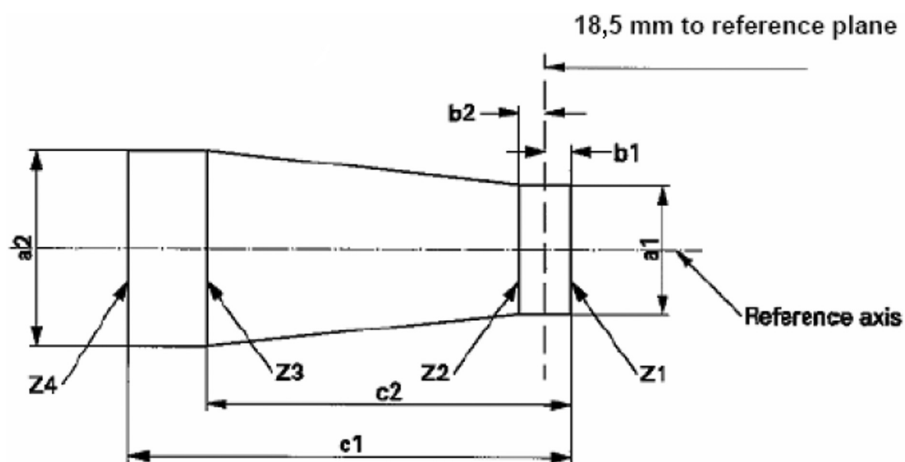
Rated values	Volts		12	12
	Watts		16	16
Test voltage	Volts		13,5	13,5
Objective values	Watts		17 max.	17 max.
	Luminous flux	PC16W	300 ± 15 %	
		PCY16W	180 ± 20 %	
		PCR16W	70 ± 20 %	
Reference luminous flux at approximately			13,5 V	White: 300 lm Amber: 180 lm Red: 70 lm

⁽⁴⁾ The filament position is checked by means of a 'Box-System'; sheet PC16W/3.⁽⁵⁾ The ends of the filament are defined as the points where, when the viewing direction is perpendicular to the plane through the filament lead-in wires as showed in the drawing on sheet PC16W/1, the projection of the outside of the end turns crosses the filament axis.⁽⁶⁾ No part of the cap beyond the reference plane shall interfere with angle α. The bulb shall be optically distortion free within the angle 2α ± 180°.⁽⁷⁾ The light emitted from standard filament lamps shall be white for category PC16W; white or amber for category PCY16W; white or red for category PCR16W.

CATEGORIES PC16W, PCY16W AND PCR16W — Sheet PC16W/3

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



	a1	a2	b1, b2	c1	c2
Filament lamps of normal production	2,9	3,9	0,5	5,2	3,8
Standard filament lamps	1,5	1,7	0,25	4,7	3,8

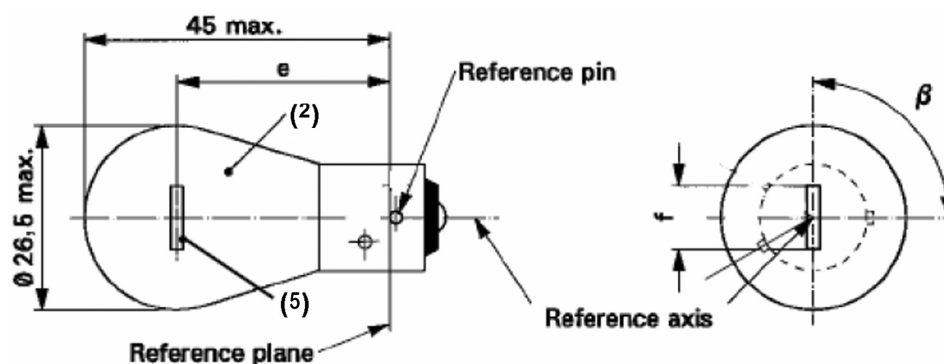
The filament position is checked in two mutually perpendicular planes, one of them being the plane through the lead-in wires.

The ends of the filament as defined on sheet PC16W/2, note 5, shall lie between Z1 and Z2 and between the lines Z3 and Z4.

The filament shall lie entirely within the limits shown.

CATEGORY PR21W — Sheet PR21W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm		Filament lamps of normal production			Standard filament lamp
		min.	nom.	max.	(⁴)
e	12 V		31,8 (³)		31,8 ± 0,3
	24 V	30,8	31,8	32,8	
f	12 V	5,5	6,0	7,0	6,0 ± 0,5
Lateral deviation (¹)	12 V			(³)	0,3 max
	24 V			1,5	
β		75°	90°	105°	90° ± 5°

Cap BAW15s in accordance with IEC Publication 60061 (sheet 7004-11E-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	24	12
	Watts	21		21
Test voltage	Volts	13,5	28,0	
Objective values	Watts	26,5 max.	29,7 max.	26,5 max.
	Luminous flux	110 ± 20 %		
Reference luminous flux at approximately 13,5 V		White: 460 lm lmRed: 110 lm		

(¹) Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis of the reference pin.

(²) The light emitted from normal production lamps shall be red (see also note 4).

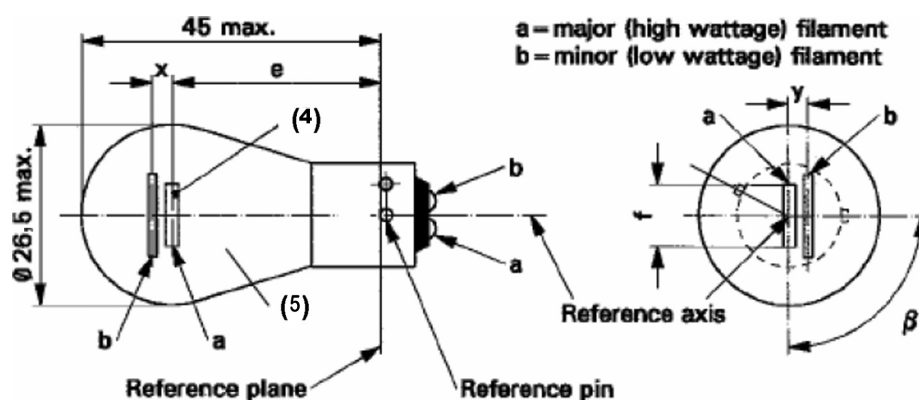
(³) To be checked by means of a 'Box-System', sheet P21W/2.

(⁴) The light emitted from standard filament lamps shall be white or red.

(⁵) In this view the filament of the 24 V type may be straight or V-shaped. This shall be indicated in the application of approval. If it is straight, the screen projection requirements, sheet P21W/2, apply. If it is V-shaped, the filament ends shall be at the same distance within ± 3 mm from the reference plane.

CATEGORY PR21/4W — Sheet PR21/4W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production ⁽⁵⁾			Standard filament lamp
	min.	nom.	max.	⁽⁶⁾
e		31,8 ⁽¹⁾		31,8 ± 0,3
f			7,0	7,0 + 0 / - 2
Lateral deviation			⁽¹⁾	0,3 max. ⁽²⁾
x, y	⁽¹⁾			2,8 ± 0,5
β	75° ⁽¹⁾	90° ⁽¹⁾	105° ⁽¹⁾	90° ± 5°

Cap BAU15d in accordance with IEC Publication 60061(sheet 7004-19-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12		24 ⁽⁴⁾		12
	Watts	21	4	21	4	21 / 4
Test voltage	Volts	13,5		28,0		13,5
Objective values	Watts	26,5 max.	5,5 max.	29,7 max.	8,8 max.	26,5 / 5,5 max.
	Luminous flux ± %	105	4	105	5	
		20	25	20	25	
Reference luminous fluxat approximately 13,5 V		White: 440 lm and 15 lm Red: 105 lm and 4 lm				

⁽¹⁾ These dimensions shall be checked by means of a 'Box-System' ⁽³⁾ based on the dimensions and tolerances shown above. 'x' and 'y' refer to the major (high-wattage) filament, not to the reference axis. Means of increasing the positioning accuracy of the filament and of the cap-holder assembly are under consideration.

⁽²⁾ Maximum lateral deviation of the major filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis of the reference pin.

⁽³⁾ The 'Box-System' is the same as for filament lamp P21/5W.

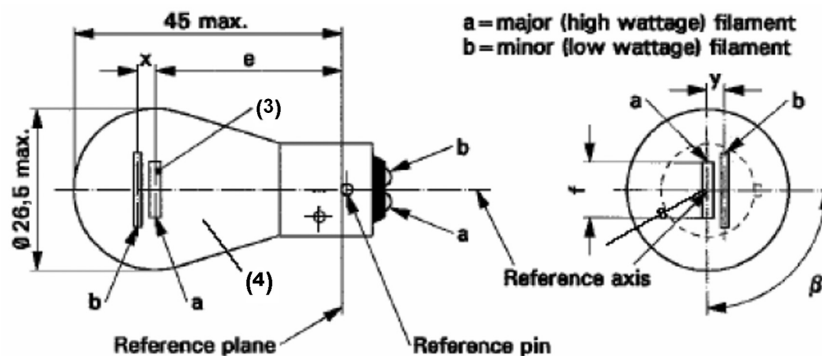
⁽⁴⁾ The 24-Volt filament lamp is not recommended for future embodiments.

⁽⁵⁾ The light emitted from normal production lamps shall be red (see also note 6).

⁽⁶⁾ The light emitted from standard filament lamps shall be white or red.

CATEGORY PR21/5W — Sheet PR21/5W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament.



Dimensions in mm		Filament lamps of normal production ⁽⁴⁾			Standard filament lamp
		min.	nom.	max.	⁽⁵⁾
e	12 V		31,8 ⁽¹⁾		31,8 ± 0,3
	24 V	30,8	31,8	32,8	
f	12 V			7,0	7,0 + 0 / - 2
Lateral deviation ⁽²⁾	12 V			⁽¹⁾	0,3 max.
	24 V			1,5	
x, y	12 V		⁽¹⁾		2,8 ± 0,3
x	24 V ⁽³⁾	- 1,0	0	1,0	
y	24 V ⁽³⁾	1,8	2,8	3,8	
β		75°	90°	105°	90° ± 5°

Cap BAW15d in accordance with IEC Publication 60061 (sheet 7004-11E-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12		24		12
	Watts	21	5	21	5	21 / 5
Test voltage	Volts	13,5		28,0		13,5
Objective values	Watts	26,5 max.	6,6 max.	29,7 max.	11,0 max.	26,5 and 6,6 max.
	Luminous flux ± %	105	8	105	10	
		20	25	20	25	
Reference luminous flux at approximately 13,5 V		White: 440 lm and 35 lm Red: 105 lm and 8 lm				

⁽¹⁾ See footnote 1 on sheet P21/5W/2.

⁽²⁾ See footnote 2 on sheet P21/5W/2.

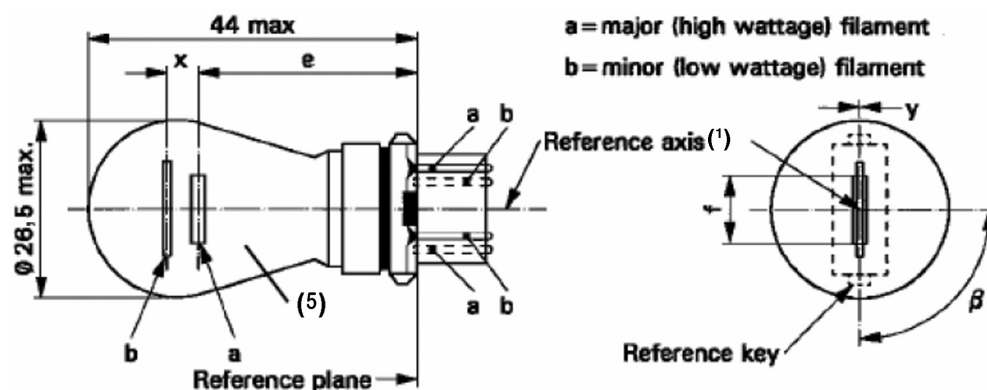
⁽³⁾ See footnote 3 on sheet P21/5W/2.

⁽⁴⁾ The light emitted from normal production lamps shall be red (see also note 5).

⁽⁵⁾ The light emitted from standard filament lamps shall be white or red.

CATEGORY PR27/7W — Sheet PR27/7W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	(⁶)
e		27,9 (³)		27,9 ± 0,3
f			9,9	9,9 + 0 / - 2
Lateral deviation (²)			(³)	0,0 ± 0,4
x (⁴)		5,1 (³)		5,1 ± 0,5
y (⁴)		0,0 (³)		0,0 ± 0,5
β	75° (³)	90°	105° (³)	90° ± 5°

Cap WU2,5x16 in accordance with IEC Publication 60061 (sheet 7004-104D-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12		12	
	Watts	27	7	27	7
Test voltage	Volts	13,5		13,5	
Objective values	Watts	32,1 max.	8,5 max.	32,1 max.	8,5 max.
	Luminous flux	110 ± 20 %	9 ± 20 %		
Reference luminous flux at approximately 13,5 V		White: 475 and 36 lm Red: 110 and 9 lm			

(¹) The reference axis is defined with respect to the reference keys and is perpendicular to the reference plane.

(²) Maximum lateral deviation of the major (high wattage) filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis through the reference keys.

(³) To be checked by means of a 'Box-System', sheets P27/7W/2 and 3.

(⁴) 'x' and 'y' denote the offset of the axis of the minor (low wattage) filament with respect to the axis of the major (high wattage) filament.

(⁵) The light emitted from normal production lamps shall be red (see also note 6).

(⁶) The light emitted from standard filament lamps shall be white or red.

CATEGORY PSX26W — Sheet PSX26W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

Figure 1

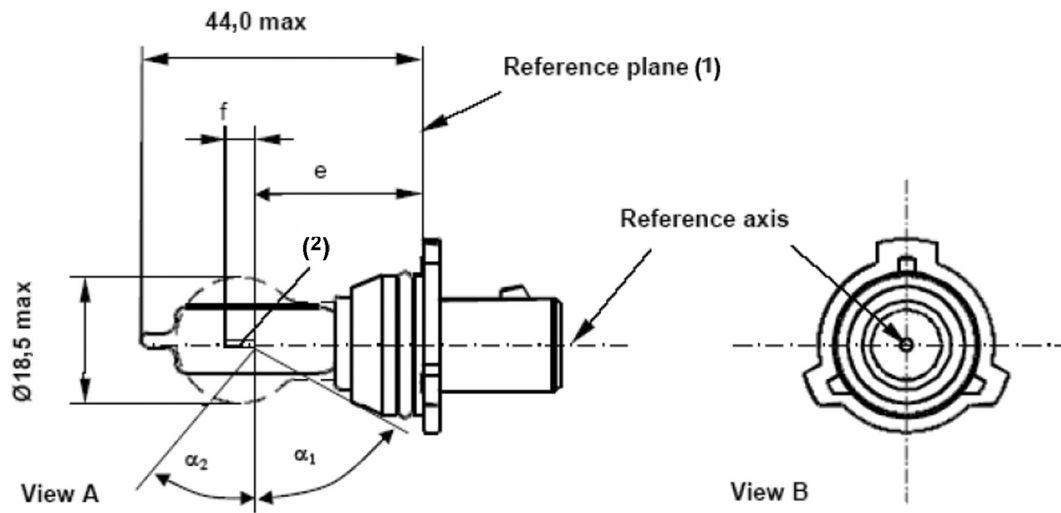
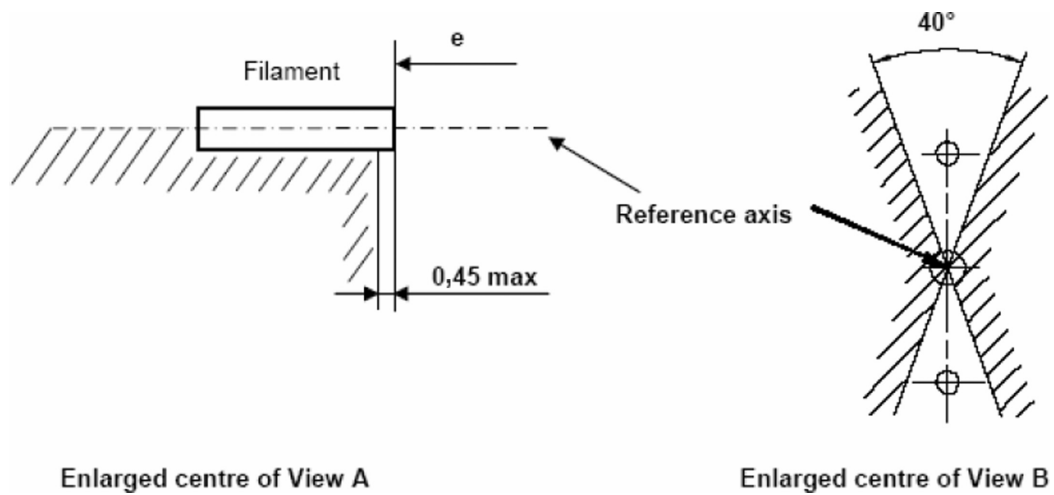
Main drawing ⁽¹⁾

Figure 2

Metal free zone ⁽³⁾

⁽¹⁾ The reference plane is defined by the meeting points of the cap-holder fit.

⁽²⁾ No actual filament diameter restrictions apply but the objective is $d_{max} = 1,1$ mm.

⁽³⁾ No opaque parts other than filament turns shall be located in the shaded area indicated in Figure 2. This applies to the rotational body within the angles $\alpha_1 + \alpha_2$.

CATEGORY PSX26W — Sheet PSX26W/2

Dimensions in mm	Filament lamps of normal production	Standard filament lamp
e ⁽⁵⁾	24,0 ⁽⁴⁾	24,0 ± 0,25
f ⁽⁵⁾	4,2 ⁽⁴⁾	4,2 ± 0,25
α1 ⁽⁶⁾	35,0° min.	35,0° min.
α2 ⁽⁶⁾	58,0° min.	58,0° min.
Cap PG18.5d-3	in accordance with IEC Publication 60061 (sheet 7004-147-1)	

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Voltage	V	12	12
	Wattage	W	26	26
Test voltage		V	13,5	13,5
Objective values	Wattage	W	26 max.	26 max.
	Luminous flux	lm	500	
		±	+ 10 % / – 10 %	
Reference luminous flux at approximately 13,2 V				465 lm
Reference luminous flux at approximately 13,5 V				500 lm

⁽⁴⁾ To be checked by means of a 'Box-System'; sheet PSX26W/3.

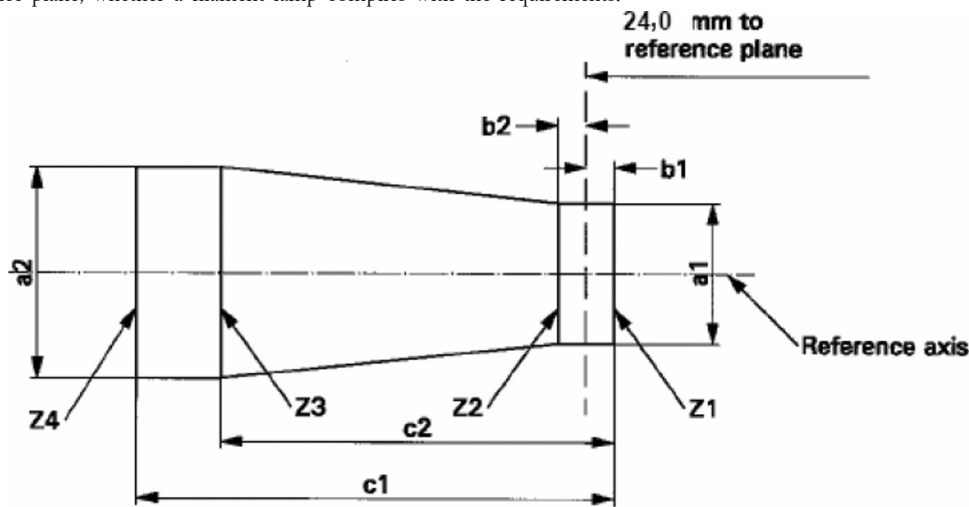
⁽⁵⁾ The ends of the filament are defined as the points where, when the viewing direction is perpendicular to the plane through the filament lead-in wires, the projection of the outside of the end turns crosses the filament axis.

⁽⁶⁾ No part of the cap beyond the reference plane shall interfere with angle α2 as shown in Figure 1 on sheet PSX26W/1. The bulb shall be optically distortion free within the angles α1 + α2. These requirements apply to the whole bulb circumference.

CATEGORY PSX26W — Sheet PSX26W/3

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane, whether a filament lamp complies with the requirements.



	a1	a2	b1, b2	c1	c2
Filament lamps of normal production	1,7	1,7	0,30	5,0	4,0
Standard filament lamps	1,5	1,5	0,25	4,7	4,0

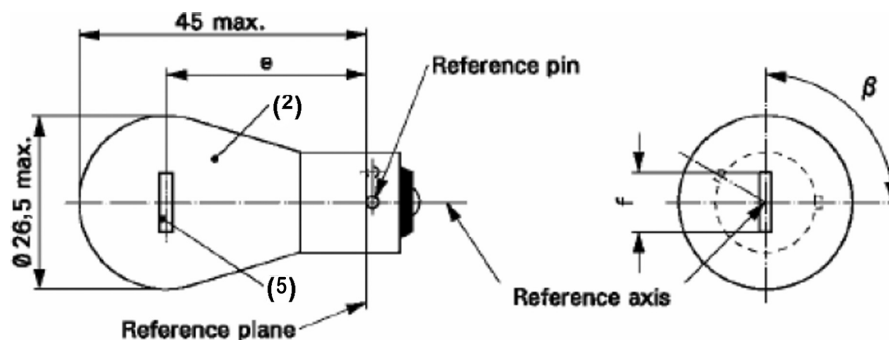
The filament position is checked in two mutually perpendicular planes, one of them being the plane through the lead-in wires.

The ends of the filament as defined on sheet PSX26W/2, note 4, shall lie between Z_1 and Z_2 and between the lines Z_3 and Z_4 .

The filament shall lie entirely within the limits shown.

CATEGORY PY21W — Sheet PY21W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm		Filament lamps of normal production			Standard filament lamp
		min.	nom.	max.	(⁴)
e	12 V		31,8 (³)		31,8 ± 0,3
	24 V	30,8	31,8	32,8	
f	12 V			7,0	7,0 + 0 / - 2
Lateral deviation (¹)	12 V			(²)	0,3 max.
	24 V			1,5	
β		75°	90°	105°	90° ± 5°

Cap BAU15s in accordance with IEC Publication 60061 (sheet 7004-19-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	24	12
	Watts	21		21
Test voltage	Volts	13,5	28,0	13,5
Objective values	Watts	26,5 max.	29,7 max.	26,5 max.
	Luminous flux	280 ± 20 %		
Reference luminous flux at approximately 13,5 V	White: 460 lm			
	Amber: 280 lm			

(¹) Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis of the reference pin.

(²) The light emitted from production lamps shall be amber (see also note 4).

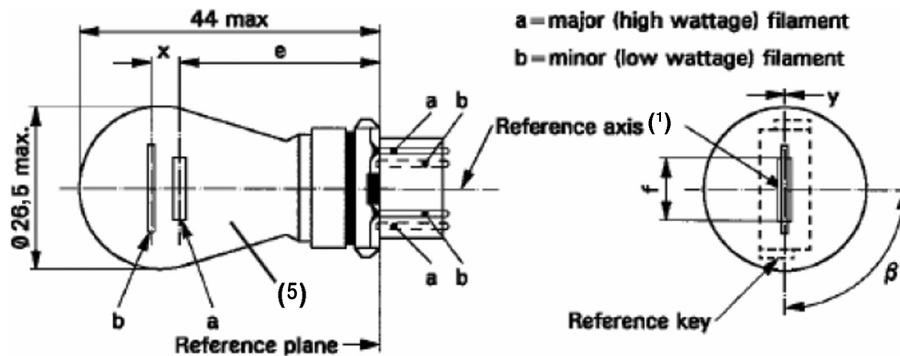
(³) To be checked by means of a 'Box-System'; sheet P21W/2.

(⁴) The light emitted from standard filament lamps shall be amber or white.

(⁵) In this view the filament of the 24 V type may be straight or V-shaped. This shall be indicated in the application of approval. If it is straight, the screen projection requirements, sheet P21W/2, apply. If it is V-shaped, the filament ends shall be at the same distance within ± 3 mm from the reference plane.

CATEGORY PY27/7W — Sheet PY27/7W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	(⁶)
e		27,9 (³)		27,9 ± 0,3
f			9,9	9,9 + 0 / - 2
Lateral deviation (²)			(³)	0,0 ± 0,4
x (⁴)		5,1 (³)		5,1 ± 0,5
y (⁴)		0,0 (³)		0,0 ± 0,5
β	75° (³)	90°	105° (³)	90° ± 5°

Cap WX2,5x16q in accordance with IEC Publication 60061 (sheet 7004-104A-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12		12	
	Watts	27	7	27	7
Test voltage	Volts	13,5		13,5	
Objective values	Watts	32,1 max.	8,5 max.	32,1 max.	8,5 max.
	Luminous flux	280 ± 15 %	21 ± 15 %		
Reference luminous flux at approximately 13,5 V		White: 475 and 36 lm Amber: 280 and 21 lm			

(¹) The reference axis is defined with respect to the reference keys and is perpendicular to the reference plane.

(²) Maximum lateral deviation of the major (high wattage) filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis through the reference keys.

(³) To be checked by means of a 'Box-System', sheets P27/7W/2 and 3.

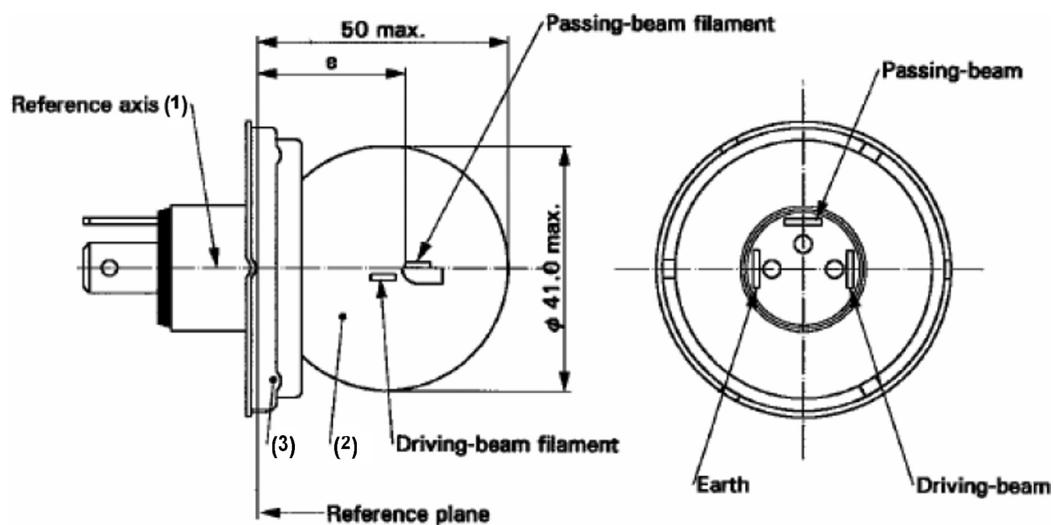
(⁴) 'x' and 'y' denote the offset of the axis of the minor (low wattage) filament with respect to the axis of the major (high wattage) filament.

(⁵) The light emitted from filament lamps of normal production shall be amber (see also note 6).

(⁶) The light emitted from standard filament lamps shall be amber or white.

CATEGORY R2 — Sheet R2/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

		Filament lamps of normal production						Standard filament lamp	
Rated values	Volts	6 ⁽⁴⁾		12 ⁽⁴⁾		24 ⁽⁴⁾		12 ⁽⁴⁾	
	Watts	45	40	45	40	55	50	45	40
Test voltage	Volts	6,3		13,2		28,0		13,2	
Objective values	Watts	53 max.	47 max.	57 max.	51 max.	76 max.	69 max.	52 + 0 % - 10 %	46 ± 5 %
	Luminous flux	720 min.	570 ± 15 %	860 min.	675 ± 15 %	1 000 min.	860 ± 15 %		
Measuring flux ⁽⁵⁾		—	450	—	450	—	450		
Reference luminous flux at approximately 12 V								700	450

⁽¹⁾ The reference axis is perpendicular to the reference plane and passes through the centre of the 45 mm cap diameter.

⁽²⁾ The colour of the light emitted shall be white or selective-yellow.

⁽³⁾ No part of the cap shall, by reflection of light emitted by the passing-beam filament, throw any stray rising ray when the filament lamp is in the normal operating position on the vehicle.

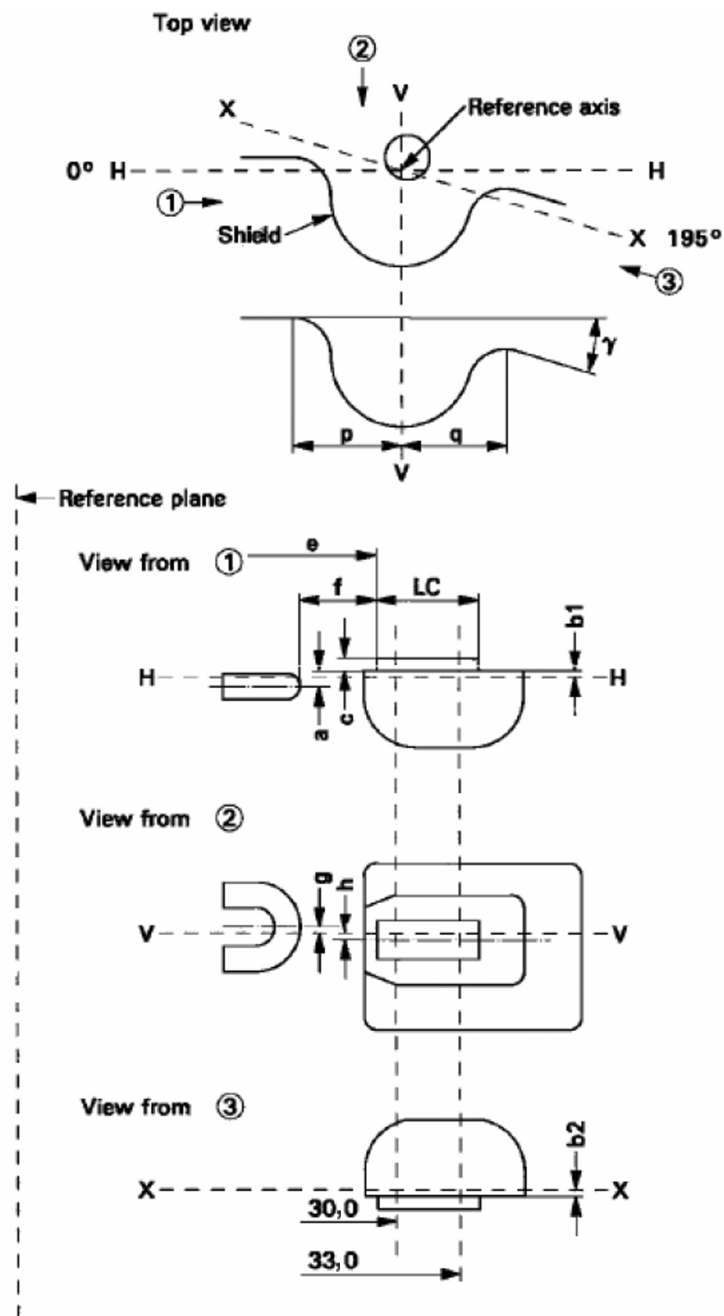
⁽⁴⁾ The values indicated on the left and on the right refer to the driving-beam filament and the passing-beam filament respectively.

⁽⁵⁾ Measuring luminous flux for measurements according to paragraph 3.9 of this Regulation.

CATEGORY R2 — Sheet R2/2

Position and dimensions (in mm) of shield and filaments

The drawings are not mandatory with respect to the design of the shield and filaments.



CATEGORY R2 — Sheet R2/3

FILAMENTS AND SHIELD POSITION AND DIMENSIONS (1)					
Dimensions in mm			Tolerance		
			Filament lamps of normal production		Standard filament lamp
			6 V	12 V	24 V
a		0,60	± 0,35		± 0,15
b1 / 30,0 (2) b1 / 33,0		0,20 b1 / 30,0 mv (3)	± 0,35		± 0,15
b2 / 30,0 (2) b2 / 33,0		0,20 b2 / 30,0 mv (3)	± 0,35		± 0,15
c / 30,0 (2) c / 33,0		0,50 c / 30,0 mv (3)	± 0,30		± 0,15
e	6 V, 12 V 24 V	28,5 28,8	± 0,35		± 0,15
f	6 V, 12 V 24 V	1,8 2,2	± 0,40		± 0,20
g		0	± 0,50		± 0,30
h / 30,0 (2) h 33,0		0 h / 30,0 mv (3)	± 0,50		± 0,30
1 / 2 (p – q)		0	± 0,60		± 0,30
lc		5,5	± 1,50		± 0,50
γ (4)		15° nom.			

Cap P45t-41 in accordance with IEC Publication 60061 (sheet 7004-95-5)

⁽¹⁾ The position and dimensions of the shield and filaments shall be checked by means of the method of measurement as described in IEC Publication 60809.

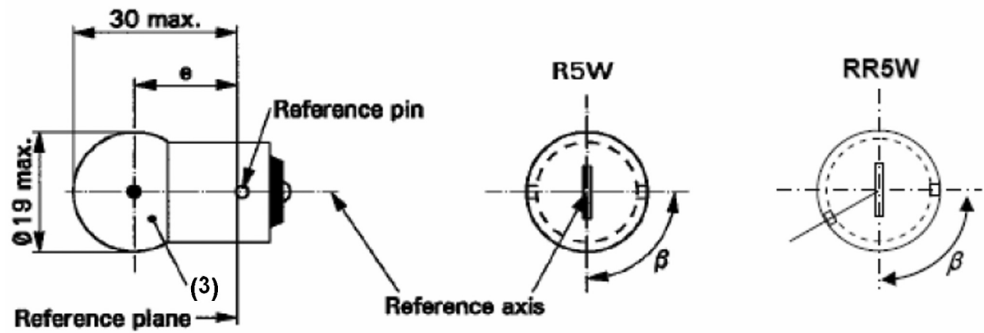
⁽²⁾ To be measured at the distance from the reference plane indicated in millimetres behind the stroke.

⁽³⁾ mv = measured value.

⁽⁴⁾ The angle γ is only for shield design and has not to be checked on finished filament lamps.

CATEGORY R5W and RR5W — Sheet R5W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	(⁴)
e	17,5	19,0	20,5	19,0 ± 0,3
Lateral deviation (²)			1,5	0,3 max.
β	60°	90°	120°	90° ± 5°
Cap: R5W: BA15s	in accordance with IEC Publication 60061			(sheet 7004-11A-9) (¹)
RR5W: BAW15s				(sheet 7004-11E-1)

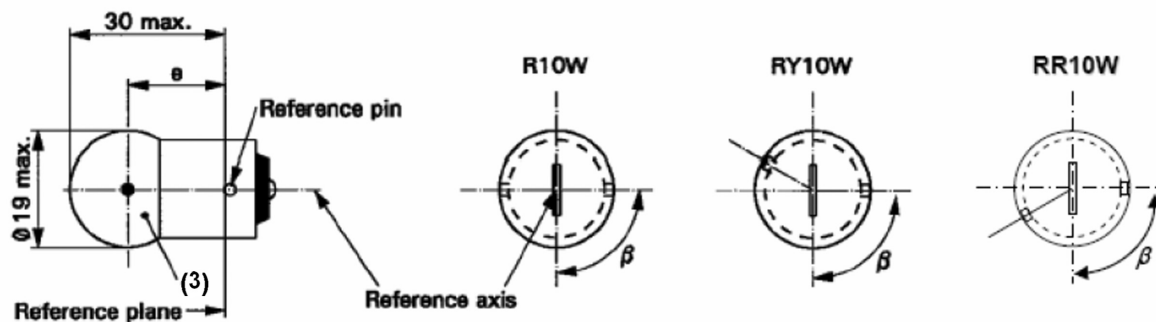
ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values		Volts	6 (⁵)	12	24	12
		Watts	5			5
Test voltage		Volts	6,75	13,5	28,0	13,5
Objective values	Watts		5,5 max.		7,7 max.	5,5 max.
	Luminous	R5W	50 ± 20 %			
	flux	RR5W	(⁵)	12 ± 25 %		
Reference luminous flux at approximately 13,5 V			White: 50 lm Red: 2 lm			

(¹) Filament lamps with cap BA15d may be used for special purposes; they have the same dimensions.
(²) Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis of the reference pin.
(³) The light emitted from standard filament lamps shall be white for category R5W; white or red for category RR5W.
(⁴) The light emitted from filament lamps of normal production shall be white for category R5W and red for category RR5W (see also note 4).
(⁵) Within RR5W no 6 V rated voltage type specified.

CATEGORIES R10W, RY10W AND RR10W — Sheet R10W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	(⁴)
e	17,5	19,0	20,5	19,0 ± 0,3
Lateral deviation (²)			1,5	0,3 max.
β	60°	90°	120°	90° ± 5°

Cap: R10W:	BA15s	in accordance with IEC Publication 60061	(sheet 7004-11A-9) (¹)
RY10W:	BAU15s		(sheet 7004-19-2)
RR10W:	BAW15s		(sheet 7004-11E-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values		Volts	6 (³)	12	24	12
		Watts	10			10
Test voltage		Volts	6,75	13,5	28	13,5
Objective values	Watts	R10W RY10W	11 max.		14 max.	11 max.
		RR10W	(⁵)	11 max.		11 max.
	Luminous flux	R10W	125 ± 20 %			
		RY10W	75 ± 20 %			
		RR10W	(⁵)	30 ± 25 %		
	Reference luminous flux at approximately 13,5 V		White: 125 lm Amber: 75 lm Red: 30 lm			

(¹) Filament lamps R10W with cap BA15d may be used for special purposes; they have the same dimensions.

(²) Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis of the reference pin.

(³) The light emitted from filament lamps of normal production shall be white for category R10W, amber for category RY10W and red for category RR10W (see also note 4)

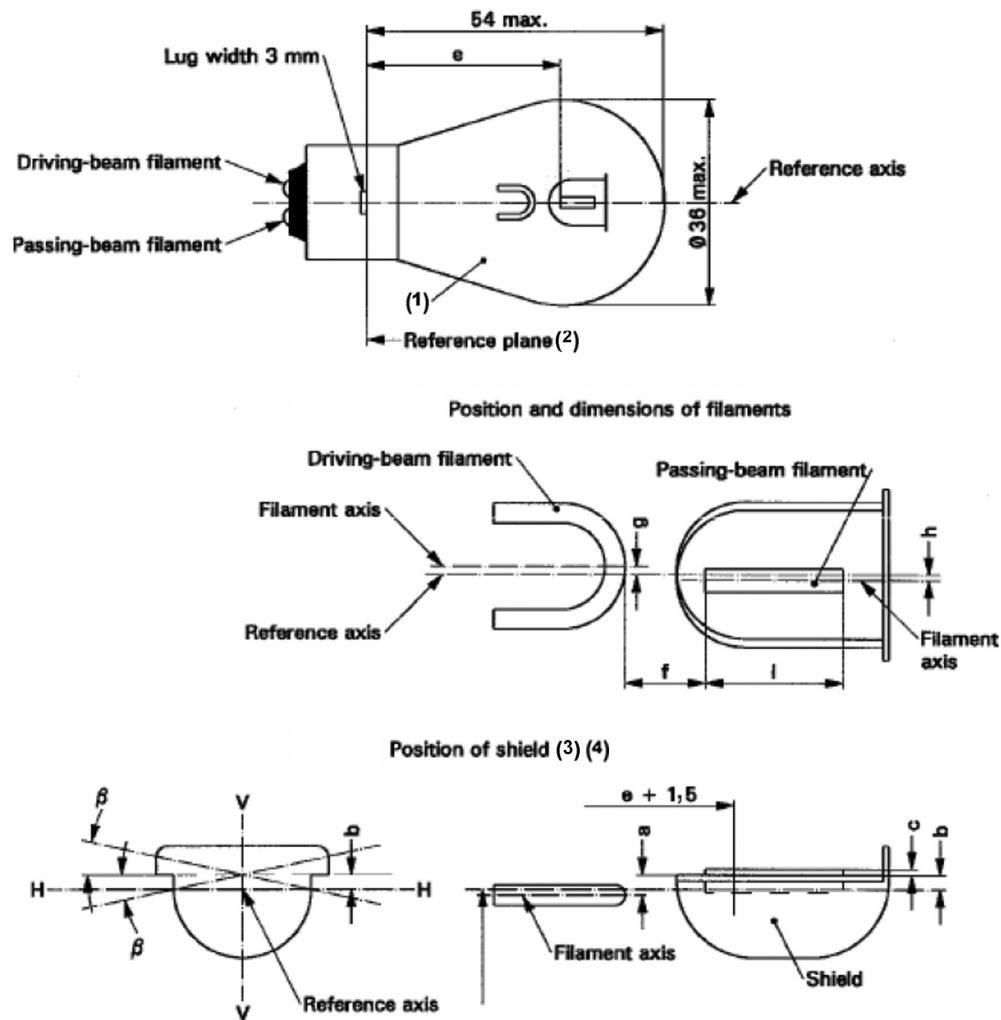
(⁴) The light emitted from standard filament lamps shall be white for category R10W; white or amber for category RY10W; white or red for category RR10W.

(⁵) Within RR10W no 6 V rated voltage type specified.

CATEGORIES S1 AND S2 — Sheet S1/S2/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

FILAMENT LAMPS FOR MOTORCYCLES



(1) The colour of the light emitted shall be white or selective-yellow.

(2) The reference plane is perpendicular to the reference axis and touches the upper surface of the lug having a width of 4,5 mm.

(3) Plane V-V contains the reference line and the centre line of the lugs.

(4) Plane H-H (the normal position of the shield) is perpendicular to plane V-V and contains the reference axis.

CATEGORIES S1 AND S2 — Sheet S1/S2/2

Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e	32,35	32,70	33,05	$32,7 \pm 0,15$
f	1,4	1,8	2,2	$1,8 \pm 0,2$
l	4,0	5,5	7,0	$5,5 \pm 0,5$
c ⁽⁵⁾	- 0,2	0,5	0,8	$0,5 \pm 0,15$
b ⁽⁵⁾	- 0,15	0,2	0,55	$0,2 \pm 0,15$
a ⁽⁵⁾	0,25	0,6	0,95	$0,6 \pm 0,15$
h	- 0,5	0	0,5	$0 \pm 0,2$
g	- 0,5	0	0,5	$0 \pm 0,2$
β ⁽⁵⁾ ⁽⁶⁾	- 2°30'	0°	+ 2°30'	$0^\circ \pm 1^\circ$

Cap BA20d in accordance with IEC Publication 60061 (sheet 7004-12-7)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

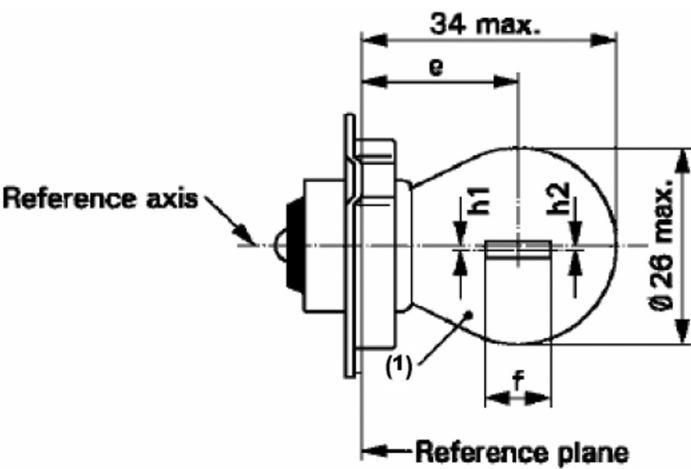
	Volts	S1	6 ⁽⁷⁾		12 ⁽⁷⁾		6	
		S2					12	
Rated values	Watts	S1	25	25	25	25	25	25
		S2	35	35	35	35	35	35
Test voltage	Volts	S1	6,75		13,5		6,75	
		S2	6,3		13,5		13,5	
Objective values	Watts	S1	25 ± 5 %	25 ± 5 %	25 ± 5 %	25 ± 5 %	25 ± 5 %	25 ± 5 %
		S2	35 ± 5 %	35 ± 5 %	35 ± 5 %	35 ± 5 %	35 ± 5 %	35 ± 5 %
	Luminous flux	S1	435 ± 20 %	315 ± 20 %	435 ± 20 %	315 ± 20 %		
		S2	650 ± 20 %	465 ± 20 %	650 ± 20 %	465 ± 20 %		
Reference luminous flux	S1	at approximately				6 V	398	284
						12 V	568	426
	S2	at approximately				13,2 V	634	457
						13,5 V	650	465

⁽⁵⁾ Dimensions a, b, c and β refer to a plane parallel to the reference plane and cutting the two edges of the shield at a distance of e + 1,5 mm.⁽⁶⁾ Admissible angular deviation of the shield plane position from the normal position.⁽⁷⁾ Values in the left-hand column refer to the driving-beam filament. Values in the right-hand column to the passing-beam filament.

CATEGORY S3 — Sheet S3/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

FILAMENT LAMP FOR MOPEDS



Dimensions in mm		Filament lamps of normal production			Standard filament lamp
		min.	nom.	max.	
e ⁽²⁾		19,0	19,5	20,0	19,5 ± 0,25
f	6 V			3,0	2,5 ± 0,5
	12 V			4,0	
h1, h2 ⁽³⁾		– 0,5	0	0,5	0 ± 0,3

Cap P26s in accordance with IEC Publication 60061 (sheet 7004-36-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

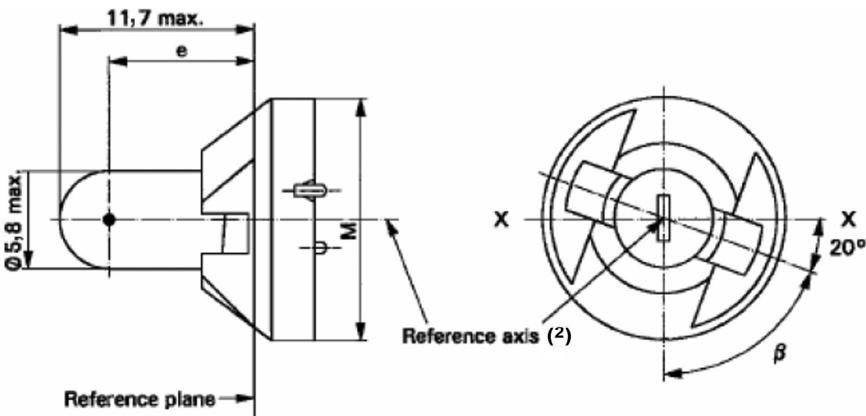
Rated values	Volts	6	12	6
	Watts	15		15
Test voltage	Volts	6,75	13,5	6,75
Objective values	Watts	15 ± 6 %		15 ± 6 %
	Luminous flux	240 ± 15 %		

Reference luminous flux: 240 lm at approximately 6,75 V

(1) The colour of the light emitted shall be white or selective-yellow.
(2) Distance related to the luminous centre.
(3) Lateral deviation of filament axis with respect to the reference axis. It is sufficient to check this deviation in two mutually perpendicular planes.

CATEGORY T1.4W — Sheet T1.4W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e	7,6	8,3	9,0	8,3 ± 0,35
Lateral deviation ⁽¹⁾			0,7	0,35 max
β	55°	70°	85°	70° ± 5°

Cap P11.5d in accordance with IEC Publication 60061 (sheet 7004-79-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	1,4	1,4
Test voltage	Volts	13,5	13,5
Objective values	Watts	1,54 max.	1,54 max.
	Luminous flux	8 ± 15 %	

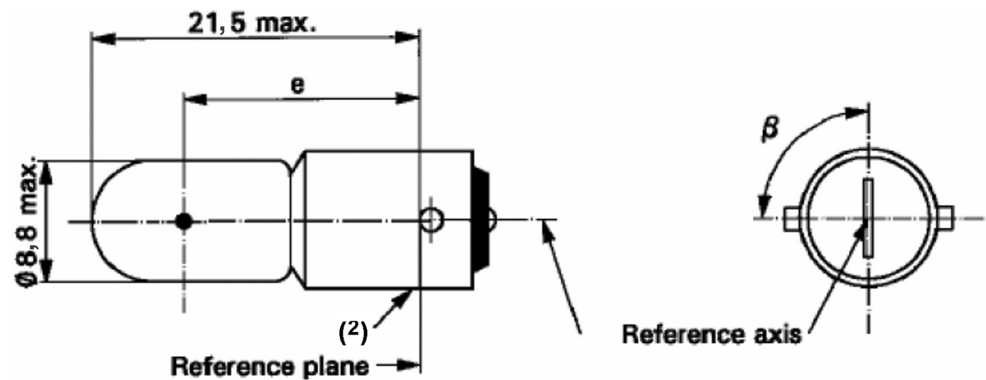
Reference luminous flux: 8 lm at approximately 13,5 V

⁽¹⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

⁽²⁾ The reference axis is perpendicular to the reference plane and passes through the centre of the circle of diameter 'M'.

CATEGORY T4W — Sheet T4W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e	13,5	15,0	16,5	15,0 ± 0,3
Lateral deviation ⁽¹⁾			1,5	0,5 max
β		90°		90° ± 5°

Cap BA9s in accordance with IEC Publication 60061 (sheet 7004-14-9)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	6	12	24	12
	Watts	4			4
Test voltage	Volts	6,75	13,5	28,0	13,5
Objective values	Watts	4,4 max.		5,5 max.	4,4 max.
	Luminous flux	3 ± 20 %			

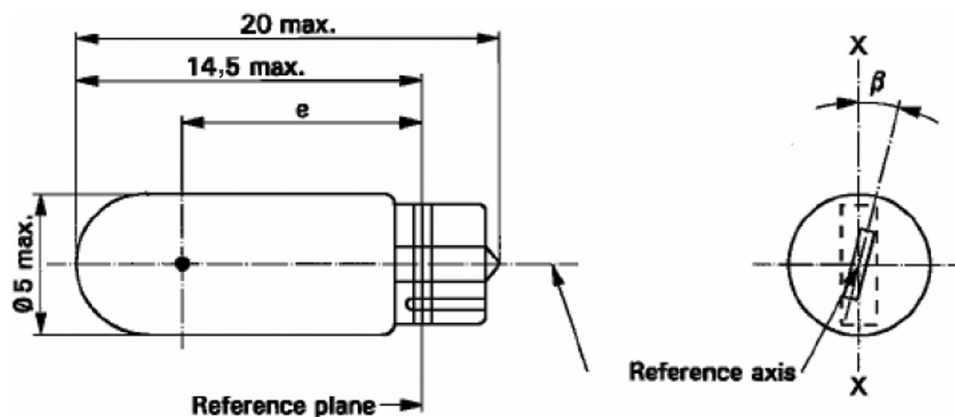
Reference luminous flux: 35 lm at approximately 13,5 V

⁽¹⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis of pins.

⁽²⁾ Over the entire length of the cap there shall be no projections or soldering extending beyond the permissible maximum diameter of the cap.

CATEGORY W2.3W — Sheet W2.3W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e	10,3	10,8	11,3	$10,8 \pm 0,3$
Lateral deviation ⁽¹⁾			1,0	0,5 max
β	-15°	0°	$+15^\circ$	$0^\circ \pm 5^\circ$

Cap W2x4.6d in accordance with IEC Publication 60061 (sheet 7004-94-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

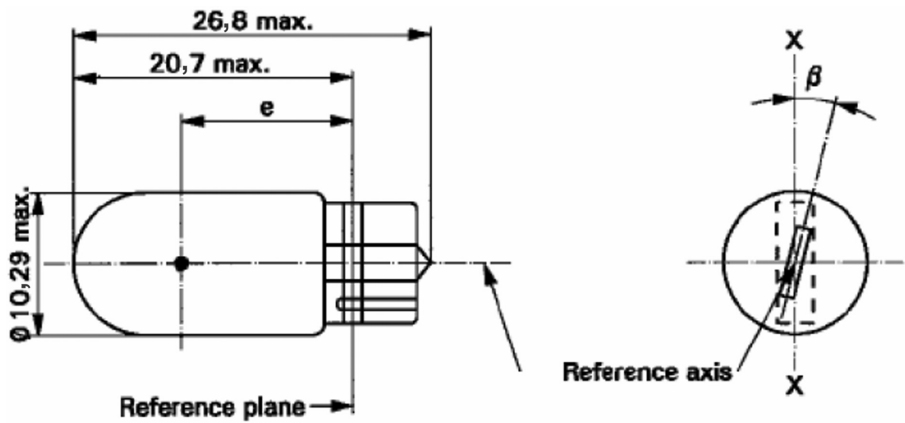
Rated values	Volts	12	12
	Watts	2,3	2,3
Test voltage	Volts	13,5	13,5
Objective values	Watts	2,5 max.	2,5 max.
	Luminous flux	$18,6 \pm 20 \%$	

Reference luminous flux: 18,6 lm at approximately 13,5 V

⁽¹⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

CATEGORY W3W — Sheet W3W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e	11,2	12,7	14,2	$12,7 \pm 0,3$
Lateral deviation ⁽¹⁾			1,5	0,5 max
β	$- 15^\circ$	0°	$+ 15^\circ$	$0^\circ \pm 5^\circ$

Cap W2.1x9.5d in accordance with IEC Publication 60061 (sheet 7004-91-3)

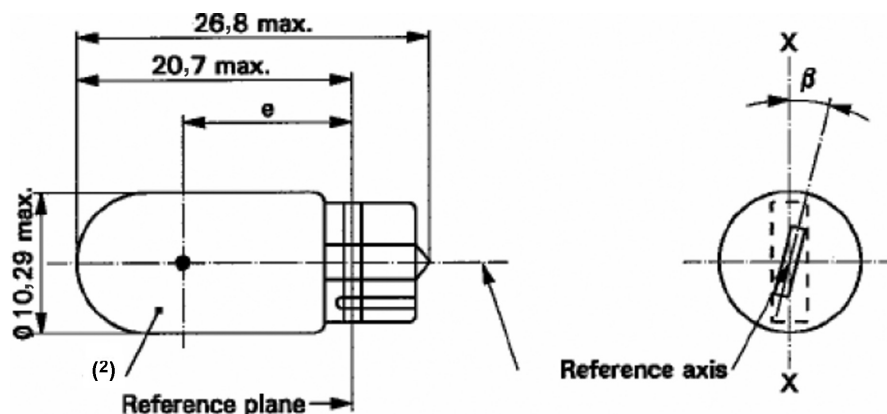
ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS					
Rated values	Volts	6	12	24	12
	Watts	3			3
Test voltage	Volts	6,75	13,5	28,0	13,5
Objective values	Watts	3,45 max.		4,6 max.	3,45 max.
	Luminous flux	$22 \pm 30 \%$			

Reference luminous flux: 22 lm at approximately 13,5 V

⁽¹⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

CATEGORY W5W, WY5W and WR5W — Sheet W5W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	(³)
e	11,2	12,7	14,2	12,7 ± 0,3
Lateral deviation (¹)			1,5	0,5 max.
β	- 15°	0°	+ 15°	0° ± 5°

Cap W2.1x9.5d in accordance with IEC Publication 60061 (sheet 7004-91-3)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values		Volts	6 (⁴)	12	24	12
		Watts	5			5
Test voltage		Volts	6,75	13,5	28,0	13,5
Objective values	Watts		5,5 max.		7,7 max.	5,5 max.
	Luminous flux	W5W	50 ± 20 %			
		WY5W	30 ± 20 %			
		WR5W	(⁴)	12 ± 25 %		

Reference luminous flux at approximately 13,5 V
 White: 50 lm
 Amber: 30 lm
 Red: 12 lm

(¹) Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

(²) The light emitted from filament lamps of normal production shall be white for category W5W, amber for category WY5W and red for category WR5W (see also note 3).

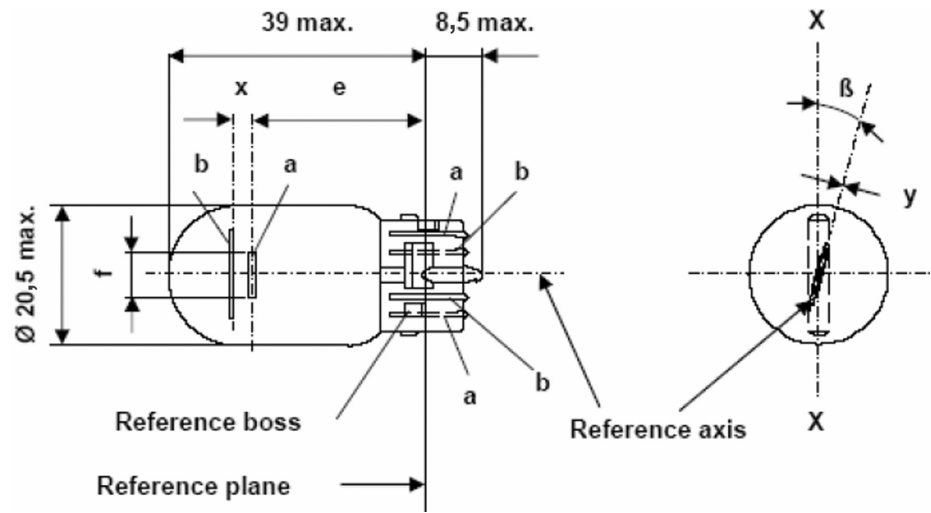
(³) The light emitted from standard filament lamps shall be white for category W5W; white or amber for category WY5W; white or red for category WR5W.

(⁴) Within WR5W no 6 V rated voltage type specified.

CATEGORY W15/5W — Sheet W15/5W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.

FILAMENT LAMP FOR MOTORCYCLES



a = major (high wattage) filament

b = minor (low wattage) filament

Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e		25,0 ⁽¹⁾		25,0 ± 0,3
f			7,5	7,5 + 0 / - 2
Lateral deviation ⁽²⁾			⁽¹⁾	0,3 max.
x ⁽³⁾		2,8 ⁽¹⁾		2,8 ± 0,3
y ⁽³⁾		0,0 ⁽¹⁾		0,0 ± 0,3
β	- 15° ⁽¹⁾	0°	+ 15° ⁽¹⁾	0° ± 5°

Cap WZ3x16q in accordance with IEC Publication 60061 (sheet 7004-151-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12		12	
	Watts	15	5	15	5
Test voltage	Volts	13,5		13,5	
Objective values	Watts	19,1 max.	6,6 max.	19,1 max.	6,6 max.
	Luminous flux	280 ± 15 %	35 ± 20 %		

Reference luminous flux: 280 lm and 35 lm at approximately 13,5 V

⁽¹⁾ To be checked by means of a 'Box-System'; sheets W15/5W/2 and 3.
⁽²⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.
⁽³⁾ 'x' and 'y' denote the offset of the axis of the minor filament with respect to the axis of the major filament.

CATEGORY W15/5W — Sheet W15/5W/2

Screen projection requirements

This test is used to determine, by checking whether:

- (a) the major filament is correctly positioned relative to the reference axis and reference plane and has an axis perpendicular, within $\pm 15^\circ$, to the plane through the axis X-X and the reference axis; and whether:
- (b) the minor filament is correctly positioned relative to the major filament, whether a filament lamp complies with the requirements.

Test procedure and requirements

1. The filament lamp is placed in a holder capable of being rotated about its axis and having either a calibrated scale or fixed stops corresponding to the angular displacement tolerance limits. The holder is then so rotated that an end view of the major filament is seen on the screen on which the image of the filament is projected. The end view of that filament shall be obtained within the angular displacement tolerance limits. ($\pm 15^\circ$).

2. Side elevation

The filament lamp placed with the cap down, the reference axis vertical and the major filament seen end-on:

- 2.1. the projection of the major filament shall lie entirely within a rectangle of height 'a' and width 'b', having its centre at the theoretical position of the centre of the filament;
- 2.2. the projection of the minor filament shall lie entirely within a rectangle of width 'c' and height 'd' having its centre at a distance 'u' above the theoretical position of the centre of the major filament.

3. Front elevation

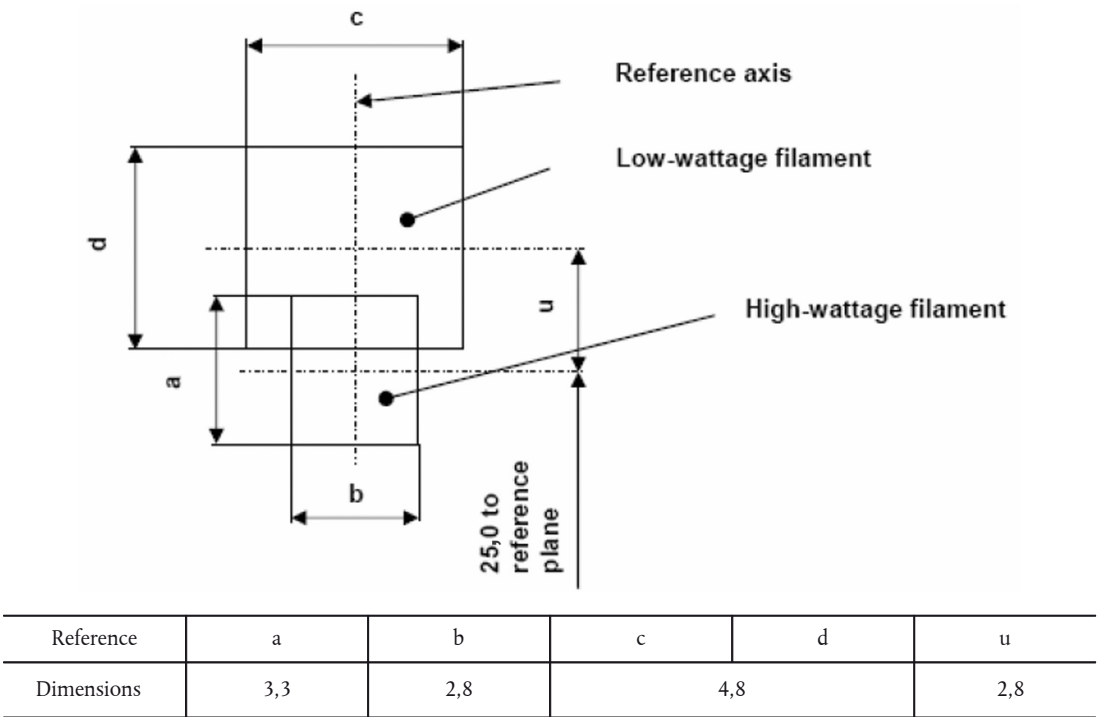
The filament lamp being placed with the cap down and the reference axis vertical, the filament lamp being viewed in a direction at right angles to axis of the major filament:

- 3.1. the projection of the major filament shall lie entirely within a rectangle of height 'a' and width 'h', centred on the theoretical position of the centre of the filament;
- 3.2. the centre of the major filament shall not be offset by more than distance 'k' from the reference axis;
- 3.3. the centre of the minor filament axis shall not be offset from the reference axis by more than ± 2 mm ($\pm 0,4$ mm for standard filament lamps).

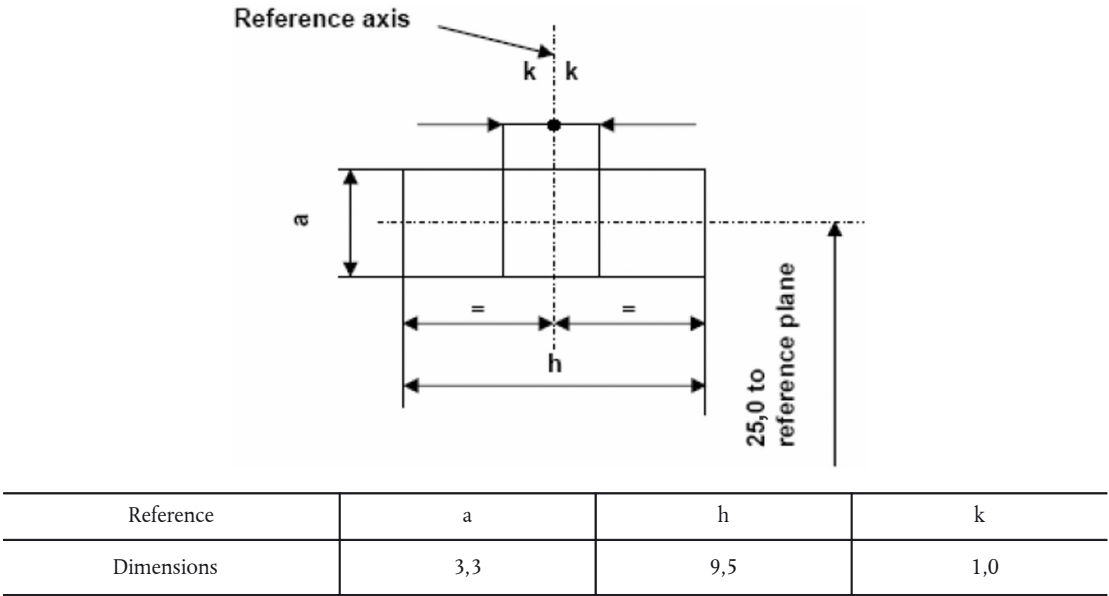
CATEGORY W15/5W — Sheet W15/5W/3

(Dimensions in millimetres)

Side elevation

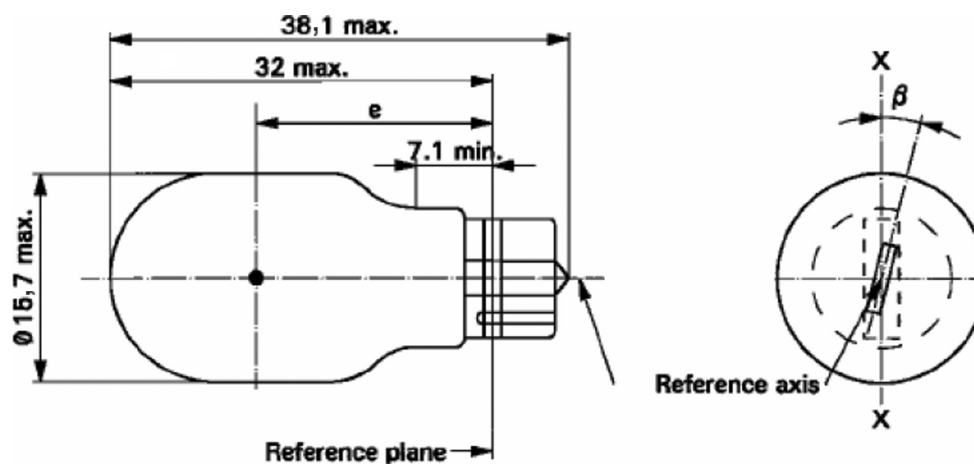


Front elevation



CATEGORY W16W — Sheet W16W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e	18,3	20,6	22,9	$20,6 \pm 0,3$
Lateral deviation ⁽¹⁾			1,0	0,5 max.
β	- 15°	0°	+ 15°	$0^\circ \pm 5^\circ$

Cap W2.1x9.5d in accordance with IEC Publication 60061 (sheet 7004-91-3)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

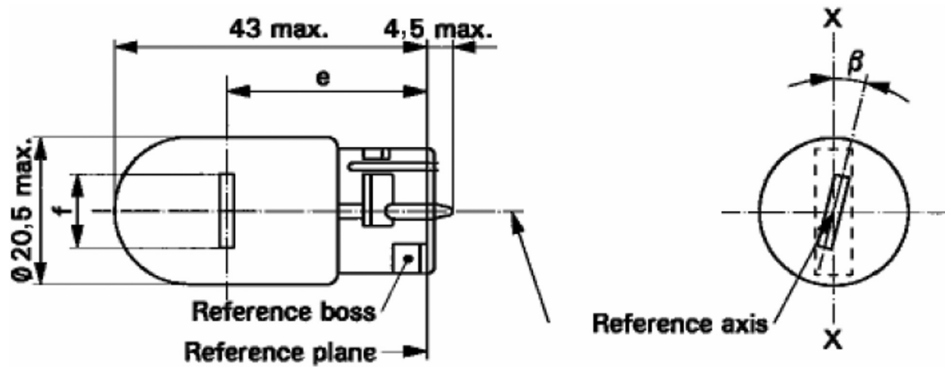
Rated values	Volts	12	12
	Watts	16	16
Test voltage	Volts	13,5	13,5
Objective values	Watts	21,35 max.	21,35 max.
	Luminous flux	$310 \pm 20 \%$	

Reference luminous flux: 310 lm at approximately 13,5 V

⁽¹⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

CATEGORY W21W — Sheet W21W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e		29,0 ⁽²⁾		29,0 ± 0,3
f			7,5	7,5 + 0 / - 2
Lateral deviation ⁽¹⁾			⁽²⁾	0,5 max.
β	- 15° ⁽²⁾	0°	+ 15° ⁽²⁾	0° ± 5°

Cap W3x16d in accordance with IEC Publication 60061 (sheet 7004-105-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS			
Rated values	Volts	12	12
	Watts	21	21
Test voltage	Volts	13,5	13,5
Objective values	Watts	26,5 max.	26,5 max.
	Luminous flux	460 ± 15 %	

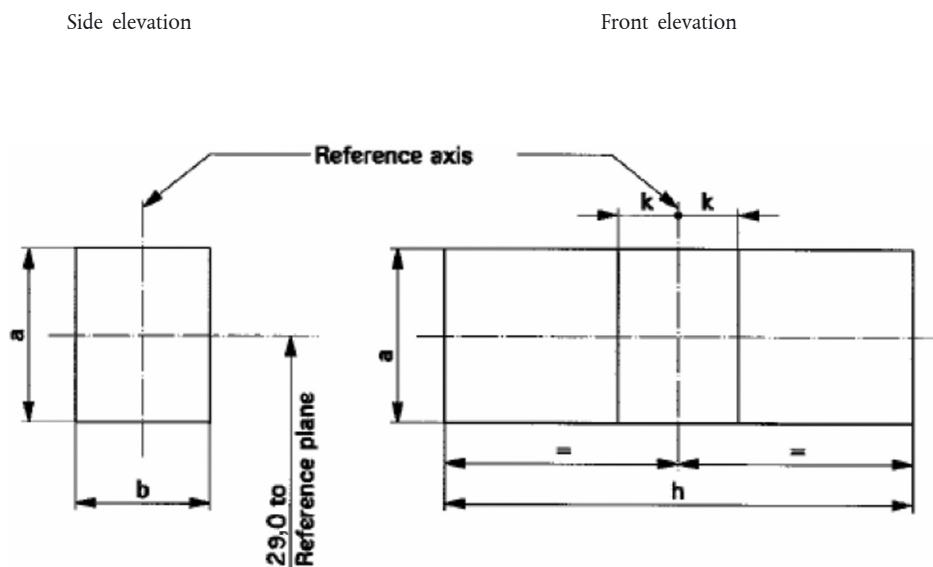
Reference luminous flux: 460 lm at approximately 13,5 V

⁽¹⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.
⁽²⁾ To be checked by means of a 'Box-System'; see sheet W21W/2.

CATEGORY W21W — Sheet W21W/2

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane and has an axis perpendicular, within $\pm 15^\circ$, to the plane through the axis X-X and the reference axis, whether a filament lamp complies with the requirements.



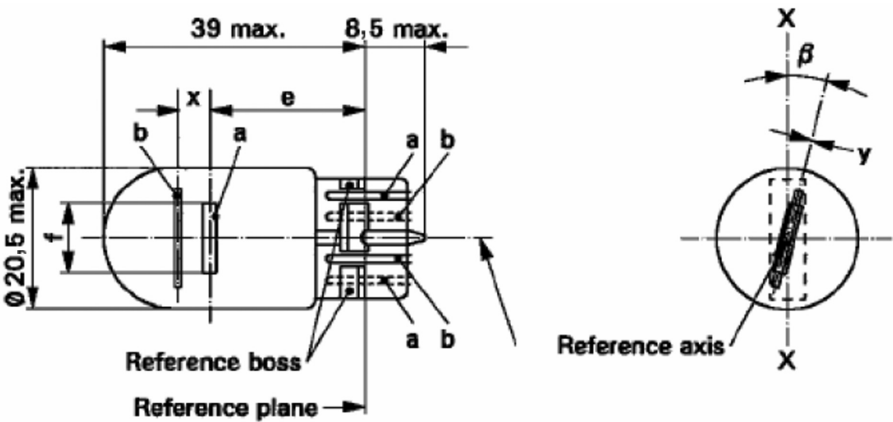
Reference	a	b	h	k
Dimension	3,5	3,0	9,5	1,0

Test procedures and requirements

- The filament lamp is placed in a holder capable of being rotated about its axis and having either a calibrated scale or fixed stops corresponding to the angular displacement tolerance limits, i.e. $\pm 15^\circ$. The holder is then so rotated that an end view of the filament is seen on the screen on to which the image of the filament is projected. The end view of the filament shall be obtained within the angular displacements tolerance limits ($\pm 15^\circ$).
- Side elevation
The filament lamp placed with the cap down, the reference axis vertical and the filament seen end-on, the projection of the filament shall lie entirely within a rectangle of height 'a' and width 'b', having its centre at the theoretical position of the centre of the filament.
- Front elevation
The filament lamp placed with the cap down and the reference axis vertical, the filament lamp being viewed in a direction at right angles to the filament axis:
 - the projection of the filament shall lie entirely within a rectangle of height 'a' and width 'h', having its centre at the theoretical position of the centre of the filament;
 - the centre of the filament shall not be offset by more than distance 'k' from the reference axis.

CATEGORY W21/5W — Sheet W21/5W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



a = major (high wattage) filament

b = minor (low wattage) filament

Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e		25,0 ⁽¹⁾		25,0 ± 0,3
f			7,5	7,5 + 0 / - 2
Lateral deviation ⁽²⁾			⁽¹⁾	0,3 max.
x ⁽³⁾		2,8 ⁽¹⁾		2,8 ± 0,3
y ⁽³⁾		0,0 ⁽¹⁾		0,0 ± 0,3
β	- 15° ⁽¹⁾	0°	+ 15° ⁽¹⁾	0° ± 5°

Cap W3x16q in accordance with IEC Publication 60061 (sheet 7004-106-3)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12		12	
	Watts	21	5	21	5
Test voltage	Volts	13,5		13,5	
Objective values	Watts	26,5 max.		26,5 max.	6,6 max.
	Luminous flux	440 ± 15 %		35 ± 20 %	

Reference luminous flux: 440 and 35 lm at approximately 13,5 V

⁽¹⁾ To be checked by means of a 'Box-System'; sheets W21/5W/2 and 3.

⁽²⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

⁽³⁾ 'x' and 'y' denote the offset of the axis of the minor filament with respect to the axis of the major filament.

CATEGORY W21/5W — Sheet W21/5W/2

Screen projection requirements

This test is used to determine, by checking whether:

- (a) the major filament is correctly positioned relative to the reference axis and reference plane and has an axis perpendicular, within $\pm 15^\circ$, to the plane through the axis X-X and the reference axis; and whether:
- (b) the minor filament is correctly positioned relative to the major filament, whether a filament lamp complies with the requirements.

Test procedure and requirements

1. The filament lamp is placed in a holder capable of being rotated about its axis and having either a calibrated scale or fixed stops corresponding to the angular displacement tolerance limits. The holder is then so rotated that an end view of the major filament is seen on the screen on which the image of the filament is projected. The end view of that filament shall be obtained within the angular displacement tolerance limits ($\pm 15^\circ$).

2. Side elevation

The filament lamp placed with the cap down, the reference axis vertical and the major filament seen end-on:

- 2.1. the projection of the major filament shall lie entirely within a rectangle of height 'a' and width 'b', having its centre at the theoretical position of the centre of the filament;
- 2.2. the projection of the minor filament shall lie entirely within a rectangle of width 'c' and height 'd' having its centre at a distance 'u' above the theoretical position of the centre of the major filament.

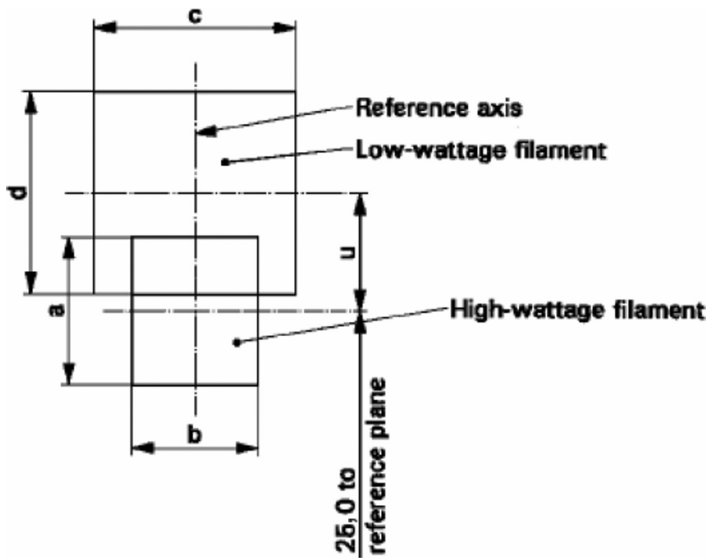
3. Front elevation

The filament lamp being placed with the cap down and the reference axis vertical, the filament lamp being viewed in a direction at right angles to axis of the major filament:

- 3.1. the projection of the major filament shall lie entirely within a rectangle of height 'a' and width 'h', centred on the theoretical position of the centre of the filament;
- 3.2. the centre of the major filament shall not be offset by more than distance 'k' from the reference axis;
- 3.3. the centre of the minor filament axis shall not be offset from the reference axis by more than ± 2 mm ($\pm 0,4$ mm for standard filament lamps).

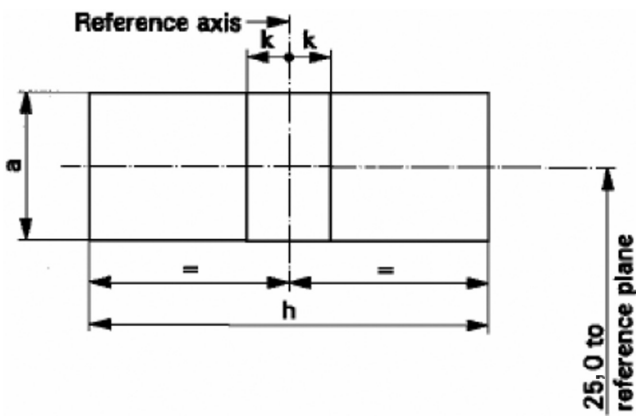
CATEGORY W21/5W — Sheet W21/5W/3

Side elevation



Reference	a	b	c	d	u
Dimension	3,5	3,0	4,8		2,8

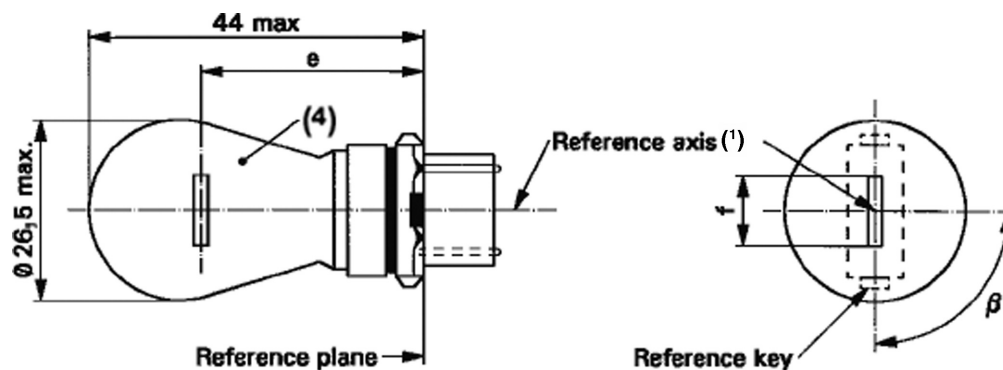
Front elevation



Reference	a	h	k
Dimension	3,5	9,5	1,0

CATEGORIES WP21W AND WPY21W — Sheet WP21W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e		27,9 ⁽³⁾		27,9 ± 0,3
f	5,5	6,0	7,0	6,0 ± 0,5
Lateral deviation ⁽²⁾			⁽³⁾	0,0 ± 0,4
β	75° ⁽³⁾	90°	105° ⁽³⁾	90° ± 5°

Cap: WP21W: WY2.5x16d in accordance with IEC Publication 60061 (sheet 7004-104B-1)
 WPY21W: WZ2.5x16d (sheet 7004-104C-1)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	21	21
Test voltage	Volts	13,5	13,5
Object-ive values	Watts	26,5 max.	26,5 max.
	Lumi-nous-flux	WP21W	460 ± 15 %
		WPY21W	280 ± 20 %
Reference luminous flux at approximately 13,5 V		White: 460 lm	
		Amber: 280 lm	

⁽¹⁾ The reference axis is defined with respect to the reference keys and is perpendicular to the reference plane.

⁽²⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing the axis through the reference keys.

⁽³⁾ To be checked by means of a 'Box-System'; sheet WP21W/2.

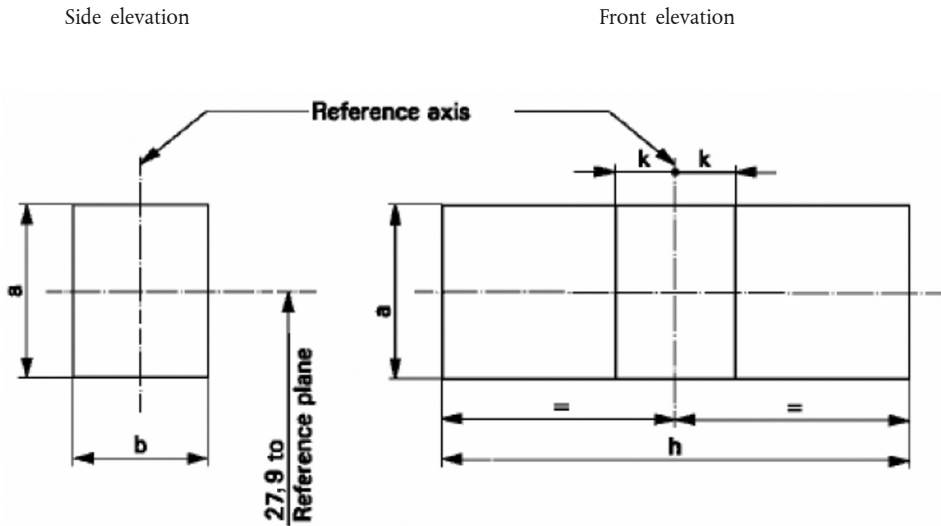
⁽⁴⁾ The light emitted from filament lamps of normal production shall be white for category WP21W and amber for category WPY21W (see also footnote 5).

⁽⁵⁾ The light emitted from standard filament lamps shall be white for category WP21W and white or amber for category WPY21W.

CATEGORIES WP21W AND WPY21W — Sheet WP21W/2

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane and has an axis perpendicular, within $\pm 15^\circ$, to the plane through the centre line of the keys and the reference axis, whether a filament lamp complies with the requirements.



Reference	a	b	h	k
Dimension	3,5	3,0	9,0	1,0

Test procedures and requirements

1. The filament lamp is placed in a holder capable of being rotated about its axis and having either a calibrated scale or fixed stops corresponding to the angular displacement tolerance limits. The holder is then so rotated that an end view of the filament is seen on the screen on to which the image of the filament is projected. The end view of the filament shall be obtained within the angular displacements tolerance limits.
2. Side elevation

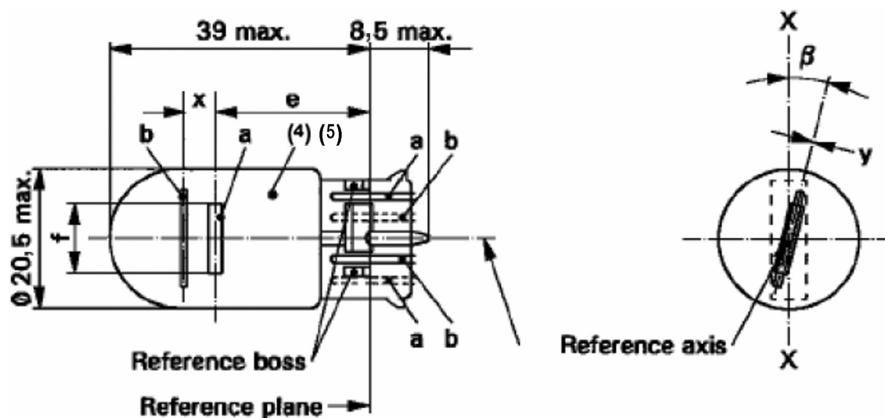
The filament lamp placed with the cap down, the reference axis vertical and the filament seen end-on, the projection of the filament shall lie entirely within a rectangle of height 'a' and width 'b', having its centre at the theoretical position of the centre of the filament.
3. Front elevation

The filament lamp placed with the cap down and the reference axis vertical, the filament lamp being viewed in a direction at right angles to the filament axis:

 - 3.1. The projection of the filament shall lie entirely within a rectangle of height 'a' and width 'h', having its centre at the theoretical position of the centre of the filament.
 - 3.2. The centre of the filament shall not be offset by more than distance 'k' from the reference axis.

CATEGORY WR21/5W — Sheet WR21/5W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



a = major (high wattage) filament

b = minor (low wattage) filament

Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e		25,0 ⁽¹⁾		25,0 ± 0,3
f			7,5	7,5 + 0 / - 2
Lateral deviation ⁽²⁾			⁽¹⁾	0,3 max.
x ⁽³⁾		2,8 ⁽¹⁾		2,8 ± 0,3
y ⁽³⁾		0,0 ⁽¹⁾		0,0 ± 0,3
β	- 15° ⁽¹⁾	0°	+ 15° ⁽¹⁾	0° ± 5°

Cap WY3x16q in accordance with IEC Publication 60061 (sheet 7004-106-3)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12		12	
	Watts	21	5	21	5
Test voltage	Volts	13,5		13,5	
Objective values	Watts	26,5 max.	6,6 max.	26,5 max.	6,6 max.
	Luminous flux	105 ± 20 %	8 ± 25 %		
Reference luminous flux at approximately 13,5 V		White: 440 lm and 35 lm Red: 105 lm and 8 lm			

⁽¹⁾ To be checked by means of a 'Box-System'; sheets W21/5W/2 and 3.

⁽²⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

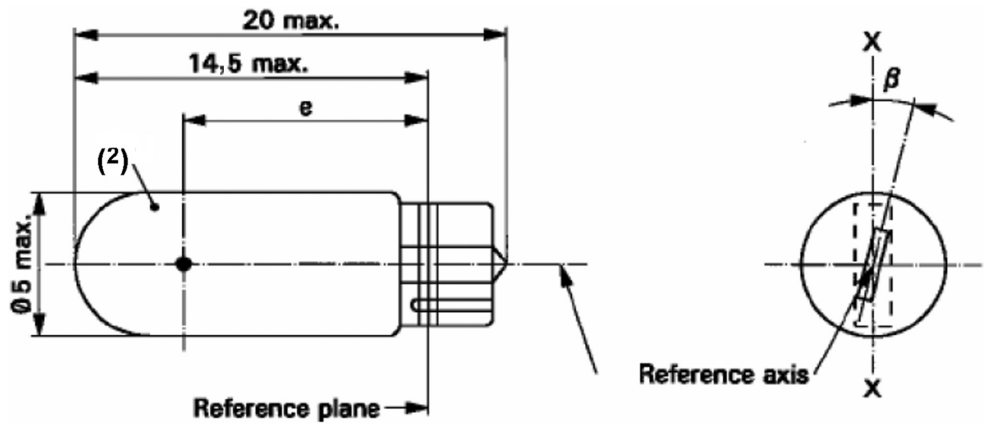
⁽³⁾ 'x' and 'y' denote the offset of the axis of the minor filament with respect to the axis of the major filament.

⁽⁴⁾ The light emitted from normal production lamps shall be red (see also note 5).

⁽⁵⁾ The light emitted from standard filament lamps shall be white or red.

CATEGORY WY2.3W — Sheet WY2.3W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e	10,3	10,8	11,3	10,8 ± 0,3
Lateral deviation ⁽¹⁾			1,0	0,5 max
β	− 15°	0°	+ 15°	0° ± 5°

Cap W2x4.6d in accordance with IEC Publication 60061 (sheet 7004-94-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS			
Rated values	Volts	12	12
	Watts	2,3	2,3
Test voltage	Volts	13,5	13,5
Objective values	Watts	2,5 max.	2,5 max.
	Luminous flux	11,2 ± 20 %	
Reference luminous flux at approximately 13,5 V		White: 18,6 lm	
		Amber: 11,2 lm	

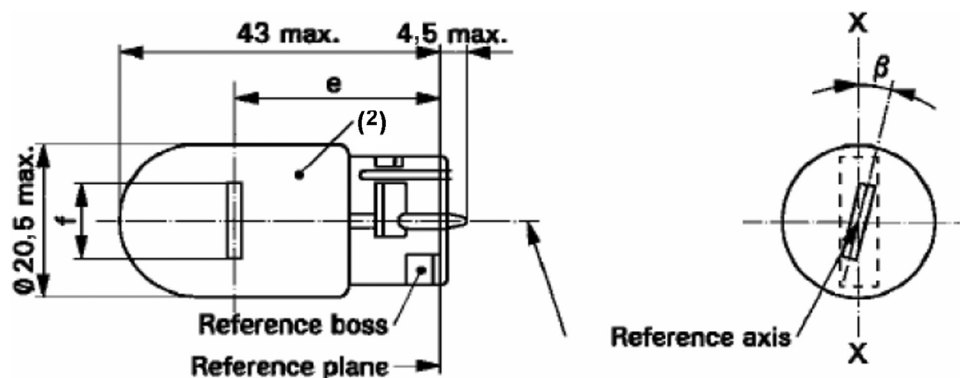
⁽¹⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

⁽²⁾ The light emitted from production lamps shall be amber (see also note 3).

⁽³⁾ The light emitted from standard filament lamps shall be amber or white.

CATEGORY WY21W — Sheet WY21W/1

The drawings are intended only to illustrate the essential dimensions (in mm) of the filament lamp.



Dimensions in mm	Filament lamps of normal production			Standard filament lamp
	min.	nom.	max.	
e		29,0 ⁽²⁾		29,0 ± 0,3
f			7,5	7,5 + 0 / - 2
Lateral deviation ⁽¹⁾			⁽²⁾	0,5 max.
β	- 15°	0°	+ 15°	0° ± 5°

Cap WX3x16d in accordance with IEC Publication 60061 (sheet 7004-105-2)

ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

Rated values	Volts	12	12
	Watts	21	21
Test voltage	Volts	13,5	13,5
Objective values	Watts	26,5 max.	26,5 max.
	Luminous flux	280 ± 20 %	
Reference luminous flux at approximately 13,5 V		White: 460 lm	
		Amber: 280 lm	

⁽¹⁾ Maximum lateral deviation of filament centre from two mutually perpendicular planes both containing the reference axis and one containing axis X-X.

⁽²⁾ The light emitted from filament lamps of normal production shall be amber (see also note 4).

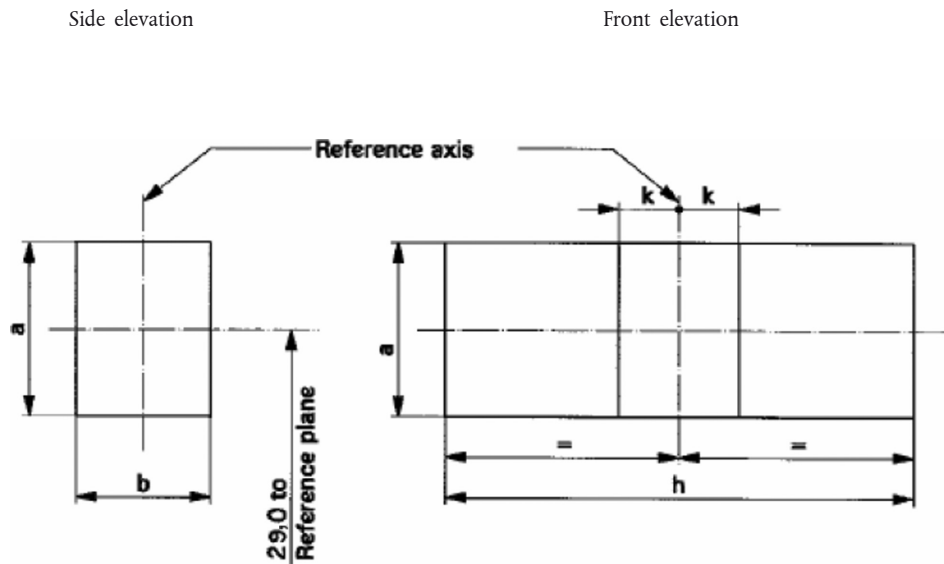
⁽³⁾ To be checked by means of a 'Box-System'; sheet WY21W/2.

⁽⁴⁾ The light emitted from standard filament lamps shall be amber or white.

CATEGORY WY21W — Sheet WY21W/2

Screen projection requirements

This test is used to determine, by checking whether the filament is correctly positioned relative to the reference axis and reference plane and has an axis perpendicular, within $\pm 15^\circ$, to the plane through the axis X-X and the reference axis, whether a filament lamp complies with the requirements.



Reference	a	b	h	k
Dimension	3,5	3,0	9,5	1,0

Test procedures and requirements

1. The filament lamp is placed in a holder capable of being rotated about its axis and having either a calibrated scale or fixed stops corresponding to the angular displacement tolerance limits, i.e. $\pm 15^\circ$. The holder is then so rotated that an end view of the filament is seen on the screen on to which the image of the filament is projected. The end view of the filament shall be obtained within the angular displacements tolerance limits ($\pm 15^\circ$).
2. Side elevation

The filament lamp placed with the cap down, the reference axis vertical and the filament seen end-on, the projection of the filament shall lie entirely within a rectangle of height 'a' and width 'b', having its centre at the theoretical position of the centre of the filament.
3. Front elevation

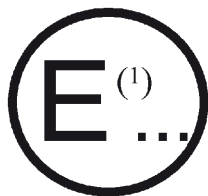
The filament lamp placed with the cap down and the reference axis vertical, the filament lamp being viewed in a direction at right angles to the filament axis:

 - 3.1. The projection of the filament shall lie entirely within a rectangle of height 'a' and width 'h', having its centre at the theoretical position of the centre of the filament.
 - 3.2. The centre of the filament shall not be offset by more than distance 'k' from the reference axis.

ANNEX 2

COMMUNICATION

(maximum format: A4 (210 × 297 mm))



issued by: Name of administration

.....

.....

.....

concerning ⁽²⁾: APPROVAL GRANTED
 APPROVAL EXTENDED
 APPROVAL REFUSED
 APPROVAL WITHDRAWN
 PRODUCTION DEFINITELY DISCONTINUED

of a type of filament lamp pursuant to Regulation No 37

Approval No. Extension No.

1. Trade name or mark of the device:
2. Manufacturer's name for the type of device:
3. Manufacturer's name and address:
4. If applicable, name and address of manufacturer's representative:

5. Submitted for approval on:
6. Technical service responsible for conducting approval tests:

7. Date of report issued by that service:
8. Number of report issued by that service:
9. Concise description:
 Category of filament lamp:
 Rated voltage:
 Rated wattage:
 Colour of the light emitted: White/selective-yellow/amber/red ⁽²⁾
 Colour coating on glass bulb: yes/no ⁽²⁾
 Halogen filament lamp: yes/no ⁽²⁾
10. Position of the approval mark:
11. Reason(s) for extension (if applicable):

12. Approval granted/refused/extended/withdrawn ⁽²⁾
13. Place:
14. Date:
15. Signature:
16. The following documents, bearing the approval mark shown above, are available on request:
-

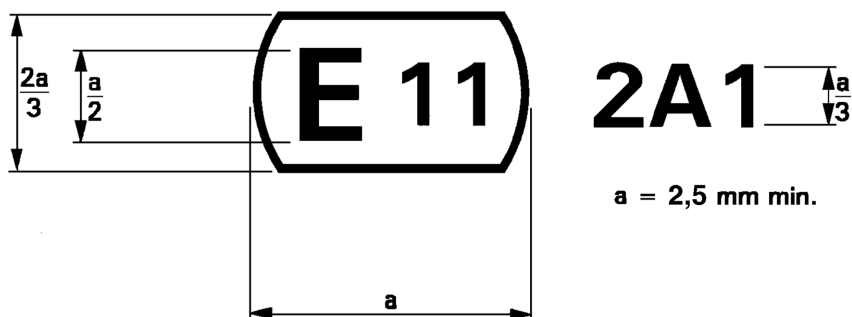
⁽¹⁾ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulation).

⁽²⁾ Strike out what does not apply.

ANNEX 3

EXAMPLE OF THE ARRANGEMENT OF THE APPROVAL MARK

(see paragraph 2.4.3)



The above approval mark affixed to a filament lamp indicates that the lamp has been approved in the United Kingdom (E11) under the approval code A1.

The first character of the approval code indicates that the approval was granted in accordance with the requirements of Regulation No 37 as amended by the 02 and 03 (*) series of amendments.

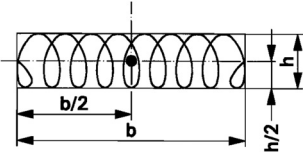
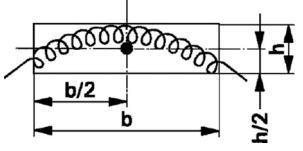
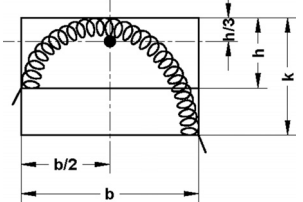
(*) Not requiring changes in the approval number.

ANNEX 4

LUMINOUS CENTRE AND SHAPES OF LAMP FILAMENTS

Save as possibly otherwise stated on the filament lamp data sheets, this standard is applicable to the determination of the luminous centre of different filament shapes.

The position of the luminous centre depends upon the filament shape.

No	Filament shapes	Observations
1		With $b > 1,5 h$, the deviation of the filament axis with respect to a plane normal to the reference axis shall not exceed 15° .
2		Only applicable to filaments which can be inscribed in a rectangle of $b > 3h$.
3		Applicable to filaments which can be inscribed in a rectangle of $b \leq 3h$, whereby, however, $k < 2h$.

The side lines of the circumscribed rectangles in Nos 2 and 3 are parallel and perpendicular, respectively, to the reference axis.

The luminous centre is the intersection of the dash-dot lines.

The drawings are intended only to demonstrate the essential dimensions.

—

ANNEX 5

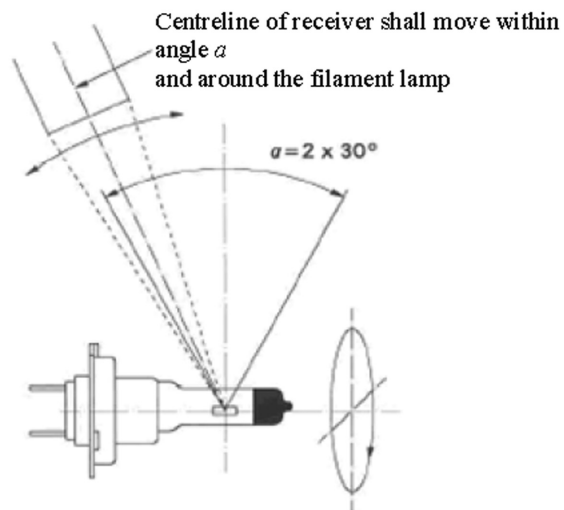
CHECKING THE COLOUR OF FILAMENT LAMPS

1. General
 - 1.1. Measurements shall be made on finished lamps. Filament lamps with secondary (outer) bulb acting as colour filter shall be handled as filament lamp with primary bulb.
 - 1.2. Tests shall be made at an ambient temperature of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.
 - 1.3. Tests shall be made at test voltage as specified in the relevant lamp data sheet.
 - 1.4. Filament lamps shall be measured preferably in the normal operating position. In case of dual filament lamps the high wattage (major or driving-beam) filament shall be operated only.
 - 1.5. Before starting a test, the stabilisation of the temperature of the filament lamp shall be obtained by operating at test voltage for 10 minutes.
2. Colour
 - 2.1. Colour tests shall be made with a measuring system that determines CIE trichromatic co-ordinates of the received light with an accuracy of $\pm 0,002$.
 - 2.2. The trichromatic coordinates shall be measured with a colorimetric receiver integrating over a right circular cone subtending an angle of minimum 5° and maximum 15° , at the centre of the filament.
 - 2.3. Measuring directions (see the figure below).
 - 2.3.1. Initially, the receiver shall be positioned perpendicular to the lamp axis and to the filament axis (or plane in case of a curved filament). After measurement the receiver shall be moved around the filament lamp in bi-directional steps of about 30° until the area specified in paragraphs 2.3.2 or 2.3.3 is covered. In each position a measurement shall be made. However, no measurement shall be made when:
 - (a) the centreline of the receiver coincides with the filament axis; or
 - (b) the line of sight between the receiver and the filament is blocked by opaque (non-transmitting) parts of the light source, such as lead wires or a second filament, if any.
 - 2.3.2. For filament lamps used in headlamps, measurements shall be made in directions around the filament lamp with the centreline of the receiver aperture located within an angle $\pm 30^{\circ}$, from the plane perpendicular to the lamp axis with the origin in the centre of the filament. In case of filament lamps with two filaments, the centre of the driving-beam filament shall be taken.
 - 2.3.3. For filament lamps used in light signalling devices, measurements shall be made in directions around the filament lamp with exception of:
 - (a) the area claimed or covered by the cap of the filament lamp; and
 - (b) the immediate transition area along the cap.

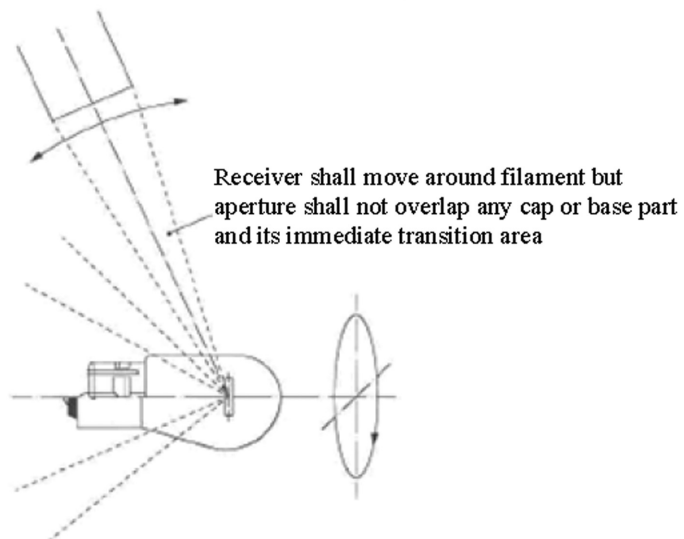
In case of filament lamps with two filaments, the centre of the major filament shall be taken.

Figure illustrating the positions of colorimetric receiver

Filament lamps for headlamps



Filament lamps for light signalling devices



ANNEX 6

MINIMUM REQUIREMENTS FOR QUALITY CONTROL PROCEDURES BY THE MANUFACTURER**1. General**

The conformity requirements shall be considered satisfied from a photometric, geometrical, visual and electrical standpoint if the specified tolerances for production filament lamps in the relevant data sheet of Annex 1 and the relevant data sheet for the caps are met.

2. Minimum requirements for verification of conformity by the manufacturer

For each type of filament lamp the manufacturer or the holder of the approval mark shall carry out tests, in accordance with the provisions of this Regulation, at appropriate intervals.

2.1. Nature of tests

Tests of conformity of these specifications shall cover their photometric, geometrical and optical characteristics.

2.2. Methods used in tests

2.2.1. Tests shall generally be carried out in accordance with the methods set out in this Regulation.

2.2.2. The application of paragraph 2.2.1 requires regular calibration of test apparatus and its correlation with measurements made by a competent authority.

2.3. Nature of sampling

Samples of filament lamps shall be selected at random from the production of a uniform batch. A uniform batch means a set of filament lamps of the same type, defined according to the production methods of the manufacturer.

2.4. Inspected and recorded characteristics

The filament lamps shall be inspected and test results recorded following the grouping of characteristics as listed in Annex 7, Table 1.

2.5. Criteria governing acceptability

The manufacturer or the holder of approval is responsible for carrying out a statistical study of the test results in order to meet the specifications laid down for verification of conformity of production in paragraph 4.1 of this Regulation.

Compliance shall be assured if the level of acceptable non-compliance per grouping of characteristics given in Table 1 of Annex 7 is not exceeded. This means that the number of filament lamps not complying with the requirement for any grouping of characteristics of any filament lamp type does not exceed the qualifying limits in the relevant Tables 2, 3 or 4 of Annex 7.

Note: Each individual filament lamp requirement shall be considered as a characteristic.

ANNEX 7

SAMPLING AND COMPLIANCE LEVELS FOR MANUFACTURER TEST RECORDS

Table 1

Characteristics

Grouping of characteristics	Grouping (*) of test records between lamp types	Minimum 12 monthly sample per grouping (*)	Acceptable level of non-compliance per grouping of characteristics (%)
Marking, legibility and durability	All types with the same external dimensions	315	1
Bulb quality	All types with the same bulb	315	1
Colour of the bulb	All types (emitting red and amber light) of the same category and colour technology	20	
External lamp dimensions (excluding cap/base)	All types of the same category	200	1
Dimensions of caps and bases	All types of the same category	200	6,5
Dimensions related to internal elements (**)	All lamps of one type	200	6,5
Initial readings, watts and lumens (**)	All lamps of one type	200	1
Colour endurance test	All lamps (emitting red, amber and white light) of one colour coating technology	20 (***)	1

(*) The assessment shall in general cover series production filament lamps from individual factories. A manufacturer may group together records concerning the same type from several factories, provided these operate under the same quality system and quality management.

(**) In case a filament lamp has more than one inner element (filament, shield) the grouping of characteristics (dimensions, watts, lumens) applies to each element separately.

(***) Representative distribution over categories of lamps using the same colour coating technology and finishing, and that comprises lamps of the smallest and the largest diameter of the outer bulb, each at the highest rated wattage.

Qualifying limits for acceptance based on different numbers of test results for each grouping of characteristics are listed in Table 2 as maximum number of non-compliance. The limits are based on an acceptable level of 1 per cent of non-compliance, assuming an acceptance probability of at least 0,95.

Table 2 (*)

Number of test results of each characteristics	Qualifying limits for acceptance
20	0
21 - 50	1
51 - 80	2
81 - 125	3
126 - 200	5
201 - 260	6
261 - 315	7
316 - 370	8
371 - 435	9
436 - 500	10
501 - 570	11
571 - 645	12

Number of test results of each characteristics	Qualifying limits for acceptance
646 - 720	13
721 - 800	14
801 - 860	15
861 - 920	16
921 - 990	17
991 - 1 060	18
1 061 - 1 125	19
1 126 - 1 190	20
1 191 - 1 249	21

Qualifying limits for acceptance based on different numbers of test results for each grouping of characteristics are listed in Table 3 given as maximum number of non-compliance. The limits are based on an acceptable level of 6,5 per cent of non-compliance, assuming an acceptance probability of at least 0,95.

Table 3

Number of lamps in records	Qualifying limit	Number of lamps in records	Qualifying limit	Number of lamps in records	Qualifying limit
- 200	21	541 - 553	47	894 - 907	73
201 - 213	22	554 - 567	48	908 - 920	74
214 - 227	23	568 - 580	49	921 - 934	75
228 - 240	24	581 - 594	50	935 - 948	76
241 - 254	25	595 - 608	51	949 - 961	77
255 - 268	26	609 - 621	52	962 - 975	78
269 - 281	27	622 - 635	53	976 - 988	79
282 - 295	28	636 - 648	54	989 - 1 002	80
296 - 308	29	649 - 662	55	1 003 - 1 016	81
309 - 322	30	663 - 676	56	1 017 - 1 029	82
323 - 336	31	677 - 689	57	1 030 - 1 043	83
337 - 349	32	690 - 703	58	1 044 - 1 056	84
350 - 363	33	704 - 716	59	1 057 - 1 070	85
364 - 376	34	717 - 730	60	1 071 - 1 084	86
377 - 390	35	731 - 744	61	1 085 - 1 097	87
391 - 404	36	745 - 757	62	1 098 - 1 111	88
405 - 417	37	758 - 771	63	1 112 - 1 124	89
418 - 431	38	772 - 784	64	1 125 - 1 138	90
432 - 444	39	785 - 798	65	1 139 - 1 152	91
445 - 458	40	799 - 812	66	1 153 - 1 165	92
459 - 472	41	813 - 825	67	1 166 - 1 179	93
473 - 485	42	826 - 839	68	1 180 - 1 192	94
486 - 499	43	840 - 852	69	1 193 - 1 206	95
500 - 512	44	853 - 866	70	1 207 - 1 220	96
513 - 526	45	867 - 880	71	1 221 - 1 233	97
527 - 540	46	881 - 893	72	1 234 - 1 249	98

(*) In accordance with ISO 2859-1:1999 'Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection' including Technical Corrigendum 1:2001.

Qualifying limits for acceptance based on different numbers of test results for each grouping of characteristics are listed in Table 4 given as a percentage of the results, assuming an acceptance probability of at least 0,95.

Table 4

Number of test results of each characteristic	Qualifying limits shown as a percentage of results. Acceptable level of 1 % of non-compliance	Qualifying limits shown as a percentage of results. Acceptable level of 6,5 % of non-compliance
1 250	1,68	7,91
2 000	1,52	7,61
4 000	1,37	7,29
6 000	1,30	7,15
8 000	1,26	7,06
10 000	1,23	7,00
20 000	1,16	6,85
40 000	1,12	6,75
80 000	1,09	6,68
100 000	1,08	6,65
1 000 000	1,02	6,55

ANNEX 8

MINIMUM REQUIREMENTS FOR SPOT CHECKS BY THE ADMINISTRATIVE AUTHORITY

1. General

The conformity requirements shall be considered satisfied from a photometric, geometrical, visual and electrical standpoint if the specified tolerances for production filament lamps in the relevant data sheet of Annex 1 and the relevant data sheet for the caps are met.

2. The conformity of mass-produced filament lamps shall not be contested if the results are in agreement with Annex 9 to this Regulation.
 3. Conformity shall be contested and the manufacturer requested to make the production meet the requirements if the results are not in agreement with Annex 9 to this Regulation.
 4. If paragraph 3 of this Annex is applied, a further sample of 250 filament lamps, selected at random from a recent production run, shall be taken within two months.
-

ANNEX 9

COMPLIANCE APPROVED BY SPOT CHECK

Compliance approved or disapproved shall be decided according to the values in Table 1. For each grouping of characteristics filament lamps shall be either accepted or rejected according to the values in Table 1 ⁽¹⁾.

Table 1

	1 % (*)		6,5 % (*)	
	Accept	Reject	Accept	Reject
First sample size: 125	2	5	11	16
If the number of non-conforming units is greater than 2 (11) and less than 5 (16) take a second sample size of 125 and assess the 250	6	7	26	27

(*) The filament lamps shall be inspected and test results recorded following the grouping of characteristics as listed in Annex 7, Table 1.

⁽¹⁾ The proposed scheme is designed to assess the compliance of filament lamps to an acceptance level of non-compliance of 1 per cent and 6,5 per cent respectively and is based on the Double Sampling Plan for Normal Inspection in IEC Publication 60410: Sampling Plans and Procedures for Inspection by Attributes.

ANNEX 10

TRANSLATIONS OF THE TERMS USED IN THE DRAWINGS IN ANNEX 1

English	
a = major (high wattage) filament	
Auxiliary reference plane	
Axis of bulb	
Axis of driving-beam filament	
Axis of high wattage filament	
Axis of low wattage filament	
Axis of passing-beam filament	
Axis of the bulb	
b = minor (low wattage) filament	
Bulb axis	
Category	
Central axis sought	
Definition of Z – Z line	
Definition: Ring centre and reference axis	
Distortion free area and black top	
Driving	
Driving-beam	
Driving-beam filament	
Driving-beam filament axis	
Earth	
Enlarged centre of View A	
Enlarged centre of View B	
Filament axis	
Filament centre	
Filament centres	
Filament position	
Filament position and dimensions	
First filament turn	
For driving-beam filament	
For passing-beam filament	
Ground	
High wattage	
High-wattage filament	
Low wattage	
Low-wattage filament	
Lug width 3 mm	
max	
Maximum lamp outlines	
Metal free zone	
Nominal position of lampholder studs	
Obscuration angle limits of cap	

English	
Offset of filament	
Passing	
Passing beam filament axis	
Passing-beam	
Passing-beam filament	
Permissible offset of filament axis	
Plane C	
Position and dimensions of filaments	
Position of the filaments	
Position of the shield	
Reference axis	
Reference boss	
Reference diameter	
Reference key	
Reference lug	
Reference mark	
Reference notch	
Reference pin	
Reference plane	
Ring centre	
Second pin	
Section A-B	
Section D-E	
Shield	
Top view	
Top view of driving-beam and passing-beam filament	
View A	
View A passing-beam filament	
View A: measuring H2	
View B	
View B driving-beam filament	
View B: measuring k, h1, h3, f	
View C	
View C: measuring h4	
View from A / View from 1	
View from B / View from 2	
View from C / View from 3	
Views A and C	
Views B and C	
x mm to reference plane	
x to reference plane	

Only the original UN/ECE texts have legal effect under international public law. The status and date of entry into force of this Regulation should be checked in the latest version of the UN/ECE status document TRANS/WP.29/343, available at:
<http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29fdocsts.html>

Amendments to Regulation No 13 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of vehicles of categories M, N and O with regard to braking

11 series of amendments

Amendments to Regulation 13 published in OJ L 257 of 30 September 2010, p. 1.

Incorporating:

11 series of amendments — Date of entry into force: 11 July 2008

Revision 6 — Amendment 1 — Corr 1

Revision 6 — Amendment 1 — Corr 2

Supplement 1 to the 11 series of amendments — Date of entry into force: 22 July 2009

Supplement 2 to the 11 series of amendments — Date of entry into force: 24 October 2009

Corrigendum 2 to the 11 series of amendments — Date of entry into force: 24 June 2009

Supplement 3 to the 11 series of amendments — Date of entry into force: 17 March 2010

Amendments to the list of contents

The title of Annex 16, amend to read:

‘Annex 16 — Compatibility between towing vehicles and trailers with respect to ISO11992 data communications’

Annex 19, insert new Appendices 7 and 8, to read:

‘Annex 19 — Appendix 7 — Vehicle stability function information document

Annex 19 — Appendix 8 — Vehicle stability function test report’

Appendices 7 and 8 (former), renumber as Appendices 9 and 10.

Insert new Annex 21

‘Annex 21 — Special requirements for vehicles equipped with a vehicle stability function

Annex 21 — Appendix 1 — Use of the dynamic stability simulation

Annex 21 — Appendix 2 — Dynamic stability simulation tool and its validation

Annex 21 — Appendix 3 — Vehicle stability function simulation tool test report’

Amendments to the main text of the Regulation

Throughout the text of Regulation No 13, replace the reference to 'ISO 11992:2003' by 'ISO 11992:2003 including ISO 11992-2:2003 and its Amd.1:2007'.

Add new paragraphs 2.34 to 2.36, to read:

‘2.34. “Vehicle Stability Function” means an electronic control function for a vehicle which improves the dynamic stability of the vehicle.

2.34.1. A vehicle stability function includes one or both of the following:

(a) directional control;

(b) roll-over control.

2.34.2. Control functions within a vehicle stability function:

2.34.2.1. “Directional control” means a function within a vehicle stability function that assists the driver, in the event of under-steer and over-steer conditions, within the physical limits of the vehicle in maintaining the direction intended by the driver in the case of a power-driven vehicle, and assists in maintaining the direction of the trailer with that of the towing vehicle in the case of a trailer.

2.34.2.2. “Roll-over control” means a function within a vehicle stability function that reacts to an impending roll-over in order to stabilise the power-driven vehicle or towing vehicle and trailer combination or the trailer during dynamic manoeuvres within the physical limits of the vehicle.

2.35. “Subject trailer” is a trailer representative of the trailer type for which type approval is sought.

2.36. The “brake factor (B_F)” is the input to output amplification ratio of the brake.’

Paragraph 4.2, for ‘(at present 10)’ read ‘(at present 11)’.

Insert a new paragraph 5.1.3.6.1, to read:

‘5.1.3.6.1. The support of messages defined within ISO 11992-2:2003 including Amd.1:2007 is specified within Annex 16 to this Regulation for the towing vehicle and trailer as appropriate.’

Paragraphs 5.1.3.6.1 and 5.1.3.6.2 (former), renumber as paragraphs 5.1.3.6.2 and 5.1.3.6.3 respectively.

Paragraph 5.2.1.30.5, delete the reference to footnote 12 and footnote 12.

Add new paragraph 5.2.1.32, to read (including the insertion of a reference to a new footnote 12 and a new footnote 12):

‘5.2.1.32. Subject to the provisions of paragraph 12.4 to this Regulation, all vehicles of categories M_2 , M_3 , N_2 and N_3 ⁽¹²⁾ having no more than 3 axles shall be equipped with a vehicle stability function. This shall include roll-over control and directional control and meet the technical requirements of Annex 21 to this Regulation.

⁽¹²⁾ Off-road vehicles, special purpose vehicles (e.g. mobile plant using non standard vehicle chassis — e.g. cranes-, hydrostatic-driven vehicles in which the hydraulic drive system is also used for braking and auxiliary functions), Class I and Class A buses of categories M_2 and M_3 , articulated buses and coaches, N_2 tractors for semi-trailer with a gross vehicle mass (GVM) between 3,5 and 7,5 tonnes, shall be excluded from this requirement.’

Paragraph 5.2.2.17.1, amend to read (including the deletion of the note):

‘5.2.2.17.1. Trailers equipped with a vehicle stability function as defined in paragraph 2.34 of this Regulation shall in the event of a failure or defect within the trailer stability function indicate the failure or defect by the separate yellow warning signal specified in paragraph 5.2.1.29.2 above via pin 5 of the ISO 7638:1997 connector.

The warning signal shall be constant and remain displayed as long as the failure or defect persists and the ignition (start) switch is in the “on” (run) position.’

Paragraph 5.2.2.22.1, delete the reference to footnote 19 and the footnote 19.

Paragraph 5.2.2.22.2, renumber the reference to footnote 20 and footnote 20 as footnote 19 and delete the reference to footnote 21 and footnote 21.

Add new paragraph 5.2.2.23, to read (including the insertion of a reference to a new footnote 20 and a new footnote 20):

‘5.2.2.23. Subject to the provisions of paragraph 12.4 to this Regulation, all vehicles of categories O₃ and O₄ ⁽²⁰⁾ having no more than 3 axles and equipped with air suspension shall be equipped with a vehicle stability function. This shall include at least roll-over control and meet the technical requirements of Annex 21 to this Regulation.

⁽²⁰⁾ Trailers for exceptional load transport and trailers with areas for standing passengers shall be excluded from this requirement.’

Add a new paragraph 12.1.6, to read (including footnote 21):

‘12.1.6. As from the official date of entry into force of the 11 series of amendments, no Contracting Party applying this Regulation shall refuse to grant type-approval under this Regulation as amended by the 11 series of amendments ⁽²¹⁾.

⁽²¹⁾ This paragraph shall not prevent Denmark from continuing to mandate a vehicle stability function meeting the requirements of this Regulation.’

Add a new paragraph 12.1.7, to read:

‘12.1.7. Supplement 1 to the 11 series of amendments to this Regulation shall be applied as specified in paragraph 12.4.1.’

Add a new paragraph 12.1.8, to read:

‘12.1.8. As from the official date of entry into force of Supplement 2 to the 11 series of amendments to this Regulation, no Contracting Party applying this Regulation shall refuse to grant approval under this Regulation as amended by Supplement 2 to the 11 series of amendments.’

Add a new paragraph 12.2.6, to read:

‘12.2.6. As from 48 months after the entry into force of Supplement 1 to the 11 series of amendments to this Regulation, Contracting Parties shall grant approvals to vehicles exempted by paragraphs 5.2.1.32 and 5.2.2.23 including the footnotes, only if they comply with the requirements of Supplement 1 to the 11 series of amendments to this Regulation.’

Add a new paragraph 12.2.7, to read:

‘12.2.7. As from 48 months after the date of entry into force of Supplement 2 to the 11 series of amendments to this Regulation, Contracting Parties applying this Regulation shall grant approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by Supplement 2 to the 11 series of amendments.’

Add a new paragraph 12.3.2, to read:

- ‘12.3.2. Starting 84 months after the entry into force of Supplement 2 to the 11 series of amendments to this Regulation, Contracting Parties applying this Regulation may refuse first national registration (first entry into service) of a vehicle which does not meet the requirements of Supplement 2 to the 11 series of amendments to this Regulation.’

Add a new paragraph 12.4, to read (including note (*)):

- ‘12.4. Mandatory provisions for vehicles equipped with a vehicle stability function
- 12.4.1. Requirements for the equipment of vehicles with vehicle stability functions as specified in paragraphs 5.2.1.32 and 5.2.2.23 of this Regulation, as amended by the 11 series of amendments, shall be applied as follows:

Vehicle category	Application date (as from the date after entry into force of the 11 series of amendments)	
	Contracting Parties applying this Regulation shall grant approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by the 11 series of amendments	Contracting Parties applying this Regulation may refuse first national or regional registration of a vehicle which does not meet the requirements of the 11 series of amendments to this Regulation
M ₂	60 months	84 months
M ₃ (Class III) (*)	12 months	36 months
M ₃ < 16 tonnes (pneumatic transmission)	24 months	48 months
M ₃ (Class II and B) (hydraulic transmission)	60 months	84 months
M ₃ (Class III) (hydraulic transmission)	60 months	84 months
M ₃ (Class III) (pneumatic control transmission and hydraulic energy transmission)	72 months	96 months
M ₃ (Class II) (pneumatic control transmission and hydraulic energy transmission)	72 months	96 months
M ₃ (other than above)	24 months	48 months
N ₂ (hydraulic transmission)	60 months	84 months
N ₂ (pneumatic control transmission and hydraulic energy transmission)	72 months	96 months
N ₂ (other than above)	48 months	72 months
N ₃ (2 axle tractors for semi-trailers)	12 months	36 months
N ₃ (2 axle tractors for semi-trailers with pneumatic control transmission (ABS))	36 months	60 months
N ₃ (3 axles with electric control transmission (EBS))	36 months	60 months
N ₃ (2 and 3 axles with pneumatic control transmission (ABS))	48 months	72 months
N ₃ (other than above)	24 months	48 months
O ₃ (combined axle load between 3,5 - 7,5 tonnes)	48 months	72 months
O ₃ (other than above)	36 months	60 months
O ₄	24 months	36 months

(*) Class III as defined in Regulation No 107.’

Paragraphs 12.4 and 12.4.1 (former), renumber as paragraphs 12.5 and 12.5.1.

Amendments to Annex 2

Annex 2, add new items 14.14 and 14.14.1, to read:

‘14.14. The vehicle is equipped with a vehicle stability function: Yes/No ⁽²⁾

If yes:

The vehicle stability function has been tested according to and fulfils the requirements of Annex 21: Yes/No ⁽²⁾

Vehicle stability function is optional equipment: Yes/No ⁽²⁾

Vehicle stability function includes directional control: Yes/No ⁽²⁾

Vehicle stability function includes roll-over control: Yes/No ⁽²⁾

14.14.1. Where an Annex 19 test report has been utilised, the test report number shall be stated:

Amendments to Annex 10

Annex 10, paragraph 1.3.1, footnote 2, amend to read:

‘⁽²⁾ In the case of multiple axles, where the axle spread between one axle and its adjacent axle is greater than 2,0 m, each individual axle shall be considered as an independent axle group.’

Amendments to Annex 11

Annex 11

Paragraph 2, amend to read:

‘2. The term “identical”, as used in paragraphs 1.1, 1.2 and 1.3 above, means identical as regards the geometric and mechanical characteristics and the materials used for the components of the vehicle referred to in those paragraphs.

In the case of trailers, these requirements are deemed to be fulfilled, with respect to paragraphs 1.1 and 1.2 above, if the identifiers referred to in Appendix 2, paragraph 3.7 of this Annex for the axle/brake of the subject trailer are contained in a report for a reference axle/brake.

A “reference axle/brake” is an axle/brake for which a test report mentioned in Appendix 2, paragraph 3.9 of this Annex exists.’

Annex 11 — Appendix 1

Table I, amend to read (including note 1):

	‘Axles of the vehicle			Reference axles		
	Static mass (P) ⁽¹⁾	Braking force needed at wheels	Speed	Test mass (P _e) ⁽¹⁾	Braking force developed at wheels	Speed
	kg	N	km/h	kg	N	km/h
Axle 1						
Axle 2						
Axle 3						
Axle 4						

⁽¹⁾ See paragraph 2.1 of Appendix 2 to this Annex.’

Table III, third row, amend to read (including the deletion of note 2):

REFERENCE AXLE REPORT No Date (copy attached)		
	Type-I	Type-III
Braking force per axle (N) (see paragraph 4.2.1, Appendix 2)		
Axle 1	$T_1 = \dots \% F_e$	$T_1 = \dots \% F_e$
Axle 2	$T_2 = \dots \% F_e$	$T_2 = \dots \% F_e$
Axle 3	$T_3 = \dots \% F_e$	$T_3 = \dots \% F_e$
...	...	...

Annex 11 — Appendix 2

Insert a new paragraph 1.2.2, to read:

- ‘1.2.2. Tests carried out in accordance with this Appendix prior to Supplement 2 to the 11 series of amendments to this Regulation which, together with any supporting data from the vehicle/axle/brake manufacturer, provide sufficient information to meet the requirements of Supplement 2 to the 11 series of amendments can be used for a new report or the extension of an existing test report without the need to carry out actual tests.’

Paragraph 2, amend to read:

‘2. SYMBOLS AND DEFINITIONS

2.1. Symbols

P = part of the vehicle mass borne by the axle under static conditions

F = normal reaction of road surface on the axle under static conditions = $P \cdot g$

F_R = total normal static reaction of road surface on all wheels of trailer

F_e = test axle load

$P_e = F_e/g$

g = acceleration due to gravity: $g = 9,81 \text{ m/s}^2$

C = brake input torque

C_0 = brake input threshold torque, definition see paragraph 2.2.2

$C_{0,dec}$ = declared brake input threshold torque

C_{max} = declared maximum brake input torque

R = tyre rolling radius (dynamic)

T = brake force at tyre/road interface

T_R = total brake force at tyre/road interface of the trailer

M = brake torque = $T \cdot R$

z = braking rate = T/F or $M/(R \cdot F)$

s = actuator stroke (working stroke plus free stroke)

s_p = see Annex 19, Appendix 9

Th_A = see Annex 19, Appendix 9

l = lever length

r = internal radius of brake drums or effective radius of brake discs

p = brake actuation pressure

Note: Symbols with the suffix “e” relate to the parameters associated with the reference brake test and may be added to other symbols as appropriate.

2.2. Definitions

2.2.1. Mass of a disc or drum

2.2.1.1. The “declared mass” is the mass declared by the manufacturer which is a representative mass for the brake identifier (see paragraph 3.7.2.2 of this Appendix).

2.2.1.2. The “nominal test mass” is the mass which the manufacturer specifies for the disc or drum with which the relevant test is carried out by the Technical Service.

2.2.1.3. The “actual test mass” is the mass measured by the Technical Service prior to the test.

2.2.2. “Brake input threshold torque”:

2.2.2.1. The brake input threshold torque “ C_0 ” is the input torque necessary to produce a measurable brake torque. This torque may be determined by extrapolation of measurements within a range not exceeding 15 percent braking rate or other equivalent methods (e.g. Annex 10, paragraph 1.3.1.1).

2.2.2.2. The brake input threshold torque “ $C_{0,dec}$ ” is the brake input threshold torque declared by the manufacturer which is a representative brake input threshold torque for the brake (see paragraph 3.7.2.2.1 of this Appendix) and is needed to produce diagram 2 of Annex 19.

2.2.2.3. The brake input threshold torque “ $C_{0,e}$ ” is determined by the procedure as defined in paragraph 2.2.2.1 above, measured by the Technical Service at the end of the test.

2.2.3. “External diameter of a disc”:

2.2.3.1. The “declared external diameter” is the external diameter of a disc declared by the manufacturer which is a representative external diameter for the disc (see paragraph 3.7.2.2.1 of this Appendix).

2.2.3.2. The “nominal external diameter” is the external diameter which the manufacturer specifies for the disc on which the relevant test is carried out by the Technical Service.

2.2.3.3. The “actual external diameter” is the external diameter measured by the Technical Service prior to the test.

2.2.4. The “effective length of the cam shaft” is the distance from the centre line of the S-cam to the centre line of the operating lever.’

Paragraph 3.4, amend to read:

‘3.4. Test conditions (general)’

Paragraphs 3.7 to 3.7.3, should be deleted.

Insert new paragraphs 3.7 to 3.9.4, to read:

‘3.7. Identification

3.7.1. The axle shall carry in a visible position at least the following identification information grouped together, in any order, in a legible and indelible manner:

(a) Axle manufacturer and/or make;

(b) Axle identifier (see paragraph 3.7.2.1 of this Appendix);

- (c) Brake identifier (see paragraph 3.7.2.2 of this Appendix);
- (d) F_e identifier (see paragraph 3.7.2.3 of this Appendix);
- (e) Base part of test report number (see paragraph 3.9 of this Appendix).

An example is given below:

Axle Manufacturer and/or make ABC ID1-XXXXXX ID2-YYYYYY ID3-11200 ID4-ZZZZZZZ

3.7.1.1. A non-integrated automatic brake adjustment device shall carry in a visible position at least the following identification information grouped together, in a legible and indelible manner:

- (a) Manufacturer and/or make;
- (b) Type;
- (c) Version.

3.7.1.2. The make and type of each brake lining shall be visible when the lining/pad is mounted on the brake shoe/back plate in a legible and indelible manner.

3.7.2. Identifiers

3.7.2.1. Axle identifier

The axle identifier categorizes an axle in terms of its braking force/torque capability as stated by the axle manufacturer.

The axle identifier shall be an alphanumeric number consisting of the four characters "ID1-" followed by a maximum of 20 characters.

3.7.2.2. Brake identifier

The brake identifier shall be an alphanumeric number consisting of the four characters "ID2-" followed by a maximum of 20 characters.

A brake with the same identifier is a brake which does not differ with regard to the following criteria:

- (a) Type of brake (e.g. drum (S-cam, wedge, etc.) or disc brake (fixed, floating, single or twin disc, etc.));
- (b) Base material (e.g. ferrous or non ferrous) with respect to calliper housing, brake carrier, brake disc and brake drum;
- (c) Dimensions with the suffix "e" according to figures 2A and 2B of Appendix 5 of this Annex;
- (d) The basic method used within the brake to generate the braking force;
- (e) In the case of disc brakes, the friction ring mounting method: fixed or floating;
- (f) Brake factor B_F ;
- (g) Different brake characteristics with respect to the requirements of Annex 11 which are not covered by subparagraph 3.7.2.2.1.

3.7.2.2.1. Differences allowed within the same brake identifier

The same brake identifier may include different brake characteristics with regard to the following criteria:

- (a) Increase in maximum declared brake input torque $C_{\max}$;
- (b) Deviation of declared brake disc and brake drum mass m_{dec} : ± 20 per cent;
- (c) Method of attachment of the lining/pad on the brake shoe/back plate;
- (d) In the case of disc brakes, increase of maximum stroke capability of the brake;
- (e) Effective length of the cam shaft;
- (f) Declared threshold torque $C_{0,\text{dec}}$;
- (g) ± 5 mm from the declared external diameter of the disc;
- (h) Type of cooling of the disc (ventilated/non-ventilated);
- (i) Hub (with or without integrated hub);
- (j) Disc with integrated drum — with or without parking brake function;
- (k) Geometric relationship between disc friction surfaces and disc mounting;
- (l) Brake lining type;
- (m) Material variations (excluding changes in base material, see paragraph 3.7.2.2) for which the manufacturer confirms that such a material variation does not change the performance with respect to the required tests;
- (n) Back plate and shoes.

3.7.2.3. F_e identifier

The F_e identifier indicates the test axle load. It shall be an alphanumeric number consisting of the four characters "ID3-" followed by the F_e value in daN, without the "daN" unit identifier.

3.7.2.4. Test report identifier

The test report identifier shall be an alphanumeric number consisting of the four characters "ID4-" followed by the base part of the test report number.

3.7.3. Automatic brake adjustment device (integrated and non-integrated)

3.7.3.1. Types of automatic brake adjustment device

The same type of automatic brake adjustment device does not differ with regard to the following criteria:

- (a) Body: base material (e.g. ferrous or non ferrous, cast iron or forged steel);
- (b) Maximal permitted brake shaft moment;
- (c) Adjustment operating principle, e.g. stroke (travel) dependent, force dependent or electronic/mechanical.

3.7.3.2. Versions of automatic brake adjustment device, with respect to the adjustment behaviour

Automatic brake adjustment devices within a type that have an impact on the running clearance of the brake are considered to be different versions.

3.8. Test criteria

The testing shall demonstrate compliance with all the requirements laid down in Appendix 2 of this Annex.

In the case that a new test report, or a test report extension, is required for a modified axle/brake within the limits specified in paragraph 3.7.2.2.1, the following criteria are used to determine the necessity for further testing taking into account worst case configurations agreed with the Technical Service.

Abbreviations shown below are used in the subsequent table:

CT (complete test)	Test according to Annex 11, Appendix 2: 3.5.1: Supplementary cold performance test 3.5.2: Fade test (Type-I test) (*) 3.5.3: Fade test (Type-III test) (*) Test according to Annex 19: 4: Cold performance characteristics for trailer brakes (*)
FT (fade test)	Test according to Annex 11, Appendix 2: 3.5.1: Supplementary cold performance test 3.5.2: Fade test (Type-I test) (*) 3.5.3: Fade test (Type-III test) (*)

(*) If applicable.

Differences according to paragraph 3.7.2.2.1 above	Test criteria
(a) Increase in maximum declared brake input torque $C_{\max}$	Change allowed without additional testing
(b) Deviation of declared brake disc and brake drum mass m_{dec} : ± 20 per cent	CT: The lightest variant shall be tested. If the nominal test mass for a new variant deviates less than 5 per cent from a previously tested variant with a higher nominal value then the test of the lighter version may be dispensed with. The actual test mass of the test specimen may vary ± 5 per cent from the nominal test mass.
(c) Method of attachment of the lining/pad on the brake shoe/back plate	The worst case specified by the manufacturer and agreed by the Technical Services conducting the test
(d) In the case of disc brakes, increase of maximum stroke capability of the brake	Change allowed without additional testing
(e) Effective length of the cam shaft	The worst case is considered to be the lowest cam shaft torsional stiffness and shall be verified by either: (i) FT or (ii) Change allowed without additional testing if by calculation the influence with respect to stroke and braking force can be shown. In this case the test report shall indicate the following extrapolated values: s_e , C_e , T_e , T_e/F_e .

Differences according to paragraph 3.7.2.2.1 above	Test criteria
(f) Declared threshold torque $C_{0,dec}$	It shall be checked that the brake performance remains within the corridors of Diagram 2 of Annex 19
(g) ± 5 mm from the declared external diameter of the disc	The worst case test is considered the smallest diameter. The actual external diameter of the test specimen may vary ± 1 mm from the nominal external diameter specified by the axle manufacturer.
(h) Type of cooling of the disc (ventilated/non-ventilated)	Each type shall be tested
(i) Hub (with or without integrated hub)	Each type shall be tested
(j) Disc with integrated drum — with or without parking brake function	Testing is not required for this feature
(k) Geometric relationship between disc friction surfaces and disc mounting	Testing is not required for this feature
(l) Brake lining type	Each type of brake lining
(m) Material variations (excluding changes in base material, see paragraph 3.7.2.2) for which the manufacturer confirms that such a material variation does not change the performance with respect to the required tests	Test not required for this condition
(n) Back plate and shoes	Worst case test conditions (*): Back plate: minimum thickness Shoe: lightest brake shoe
(*) No test is required if the manufacturer can demonstrate that a change does not effect the stiffness	

3.8.1. If an automatic brake adjustment device deviates from a tested one according to paragraphs 3.7.3.1 and 3.7.3.2 an additional test according to paragraph 3.6.2 of this Appendix is necessary.

3.9. Test report

3.9.1. Test report number

The test report number consists of two parts: a base part and a suffix which identifies the issue level of the test report.

The base part, consisting of a maximum of 20 characters, and suffix shall be clearly separated from each other using e.g. a dot or slash.

The base part of the test report number shall only cover brakes with the same brake identifier and the same brake factor (according to paragraph 4 of Annex 19 to this Regulation).

3.9.2. Test code

In addition to the test report number a “test code” consisting of up to eight characters (e.g. ABC123) shall indicate the test results applicable to the identifiers and the test specimen, which is described by the details given in paragraph 3.7 above.

3.9.3. Test results

3.9.3.1. The result of tests carried out in accordance with paragraphs 3.5 and 3.6.1 of this Appendix shall be reported on a form, a model of which is shown in Appendix 3 to this Annex.

3.9.3.2. In the case of a brake installed with an alternative brake adjustment device the results of tests carried out in accordance with paragraph 3.6.2 of this Appendix shall be reported on a form, a model of which is shown in Appendix 4 to this Annex.

3.9.4. Information document

An information document, provided by the axle or vehicle manufacturer, containing at least the information defined in Appendix 5 to this Annex shall be part of the Test Report.

The information document shall identify, if applicable, the various variants of the brake/axle equipment with respect to the essential criteria listed in paragraph 3.7.2.2.1 above.'

Paragraph 4.1, amend to read:

'4.1. Verification of components

The brake specification of the vehicle to be type approved shall comply with the requirements laid down in paragraphs 3.7 and 3.8 above.'

Paragraphs 4.1.1 to 4.1.7, should be deleted.

Paragraph 4.3.1.4, the formula, amend to read:

$$'T = (T_e - 0,01 \cdot F_e) \frac{C - C_o}{C_e - C_{oe}} \cdot \frac{R_e}{R} + 0,01 \cdot F'$$

Paragraph 4.3.2, the formula, amend to read:

$$\frac{T_R}{F_R} = \frac{\Sigma T}{\Sigma F}$$

Annex 11 — Appendix 3

Amend to read (including the deletion of figures 1A, 1B, 2A and 2B):

*'APPENDIX 3***Model test report form as prescribed in paragraph 3.9 of Appendix 2 to this Annex**

TEST REPORT No:

Base part: ID4-

Suffix:

1. GENERAL

1.1. Axle manufacturer (name and address):

1.1.1. Make of axle manufacturer:

1.2. Brake manufacturer (name and address):

1.2.1. Brake identifier: ID2-.....

1.2.2. Automatic brake adjustment device: integrated/non-integrated ⁽¹⁾

1.3. Manufacturer's Information Document:

2. TEST RECORD

The following data has to be recorded for each test:

- 2.1. Test code (see paragraph 3.9.2 of Appendix 2 of this Annex):
- 2.2. Test specimen: (precise identification of the variant tested related to the Manufacturer's Information Document. See also paragraph 3.9.2 of Appendix 2 of this Annex)
- 2.2.1. Axle
- 2.2.1.1. Axle identifier: ID1-
- 2.2.1.2. Identification of tested axle:
- 2.2.1.3. Test axle load (Fe identifier): ID3- daN
- 2.2.2. Brake
- 2.2.2.1. Brake identifier: ID2-
- 2.2.2.2. Identification of tested brake:
- 2.2.2.3. Maximum stroke capability of the brake ⁽²⁾:
- 2.2.2.4. Effective length of the cam shaft ⁽³⁾:
- 2.2.2.5. Material variation as per paragraph 3,8 (m) of Appendix 2 of this Annex:
- 2.2.2.6. Brake drum/disc ⁽¹⁾
- 2.2.2.6.1. Actual test mass of disc/drum ⁽¹⁾:
- 2.2.2.6.2. Nominal external diameter of disc ⁽²⁾:
- 2.2.2.6.3. Type of cooling of the disc ventilated/non-ventilated ⁽¹⁾
- 2.2.2.6.4. With or without integrated hub ⁽¹⁾
- 2.2.2.6.5. Disc with integrated drum — with or without parking brake function ⁽¹⁾ ⁽²⁾
- 2.2.2.6.6. Geometric relationship between disc friction surfaces and disc mounting:
- 2.2.2.6.7. Base material:
- 2.2.2.7. Brake lining or pad ⁽¹⁾
- 2.2.2.7.1. Manufacturer:
- 2.2.2.7.2. Make:
- 2.2.2.7.3. Type:
- 2.2.2.7.4. Method of attachment of the lining/pad on the brake shoe/back plate ⁽¹⁾:
- 2.2.2.7.5. Thickness of back plate, weight of shoes or other describing information (Manufacturer's Information Document) ⁽¹⁾:

2.2.2.7.6. Base material of brake shoe/back plate ⁽¹⁾:

2.2.3. Automatic brake adjustment device (not applicable in the case of integrated automatic brake adjustment device) ⁽¹⁾

2.2.3.1. Manufacturer (name and address):

2.2.3.2. Make:

2.2.3.3. Type:

2.2.3.4. Version:

2.2.4. Wheel(s) (dimensions see Figures 1A and 1B in Appendix 5 of this Annex)

2.2.4.1. Reference tyre rolling radius (R_e) at test axle load (F_e):

2.2.4.2. Data of the fitted wheel during testing:

Tyre size	Rim size	X_e (mm)	D_e (mm)	E_e (mm)	G_e (mm)

2.2.5. Lever length l_e :

2.2.6. Brake actuator

2.2.6.1. Manufacturer:

2.2.6.2. Make:

2.2.6.3. Type:

2.2.6.4. (Test) Identification number:

2.3. Test results (corrected to take account of rolling resistance of $0,01 \cdot F_e$)

2.3.1. In the case of vehicles of categories O_2 and O_3

Test type:		0	I	
Annex 11, Appendix 2, paragraph:		3.5.1.2	3.5.2.2/3	3.5.2.4
Test speed	km/h	40	40	40
Brake actuator pressure p_e	kPa		—	
Braking time	min	—	2,55	—
Brake force developed T_e	daN			
Brake efficiency T_e/F_e	—			
Actuator stroke s_e	mm		—	
Brake input torque C_e	Nm		—	
Brake input threshold torque $C_{0,e}$	Nm		—	

2.3.2. In the case of vehicles of category O₄

Test type:		0	III	
Annex 11, Appendix 2, paragraph:		3.5.1.2	3.5.3.1	3.5.3.2
Test speed initial	km/h	60		60
Test speed final	km/h			
Brake actuator pressure p _e	kPa		—	
Number of brake applications	—	—	20	—
Duration of braking cycle	s	—	60	—
Brake force developed T _e	daN			
Brake efficiency T _e /F _e	—			
Actuator stroke s _e	mm		—	
Brake input torque C _e	Nm		—	
Brake input threshold torque C _{0,e}	Nm		—	

2.3.3. This item is to be completed only when the brake has been subject to the test procedure defined in paragraph 4 of Annex 19 to this Regulation to verify the cold performance characteristics of the brake by means of the brake factor (B_F).

2.3.3.1. Brake factor B_F:

2.3.3.2. Declared threshold torque C_{0,dec} Nm

2.3.4. Performance of the automatic brake adjustment device (if applicable)

2.3.4.1. Free running according to paragraph 3.6.3 of Annex 11, Appendix 2: yes/no ⁽¹⁾

3. APPLICATION RANGE

The application range specifies the axle/brake variants that are covered in this test report, by showing which variables are covered by the individual test codes.

4. This test has been carried out and the results reported in accordance with Appendix 2 to Annex 11 and where appropriate paragraph 4 of Annex 19 to Regulation No 13 as last amended by the ... series of amendments.

At the end of the test defined in paragraph 3.6 of Annex 11, Appendix 2, ⁽⁴⁾ the requirements of paragraph 5.2.2.8.1 of Regulation No 13 were deemed to be fulfilled/not fulfilled ⁽¹⁾.

TECHNICAL SERVICE ⁽⁵⁾ CARRYING OUT THE TEST

Signed:Date:

5. APPROVAL AUTHORITY ⁽⁵⁾

Signed:Date:

⁽¹⁾ Strike out what does not apply.

⁽²⁾ Applies to disc brakes only.

⁽³⁾ Applies to drum brakes only.

⁽⁴⁾ Only to be completed when an automatic brake wear adjustment device is installed.

⁽⁵⁾ To be signed by different persons even when the Technical Service and Approval Authority are the same or alternatively, a separate Approval Authority authorization is issued with the report.

Annex 11 — Appendix 4

Item 1.1, replace ‘Technically permissible axle load (P_e)’ by ‘Test axle load (F_e identifier): ID3-’.

Add a new Appendix 5 to Annex 11, to read:

‘APPENDIX 5

Trailer axle and brake information document with respect to the alternative Type I and Type III procedure

- 1. GENERAL
- 1.1. Name and address of axle or vehicle manufacturer:
- 2. AXLE DATA
- 2.1. Manufacturer (name and address):
- 2.2. Type/variant:
- 2.3. Axle identifier: ID1-.....
- 2.4. Test axle load (F_e): daN
- 2.5. Wheel and brake data according to the following figures 1A and 1B

Figure 1A

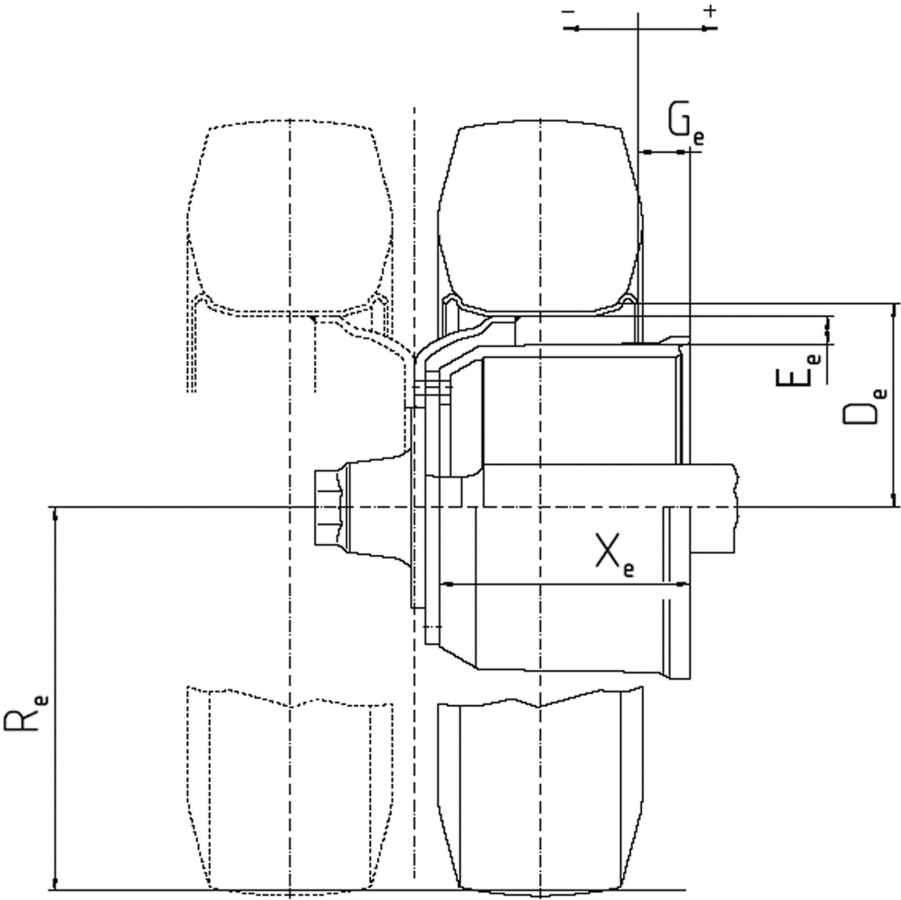
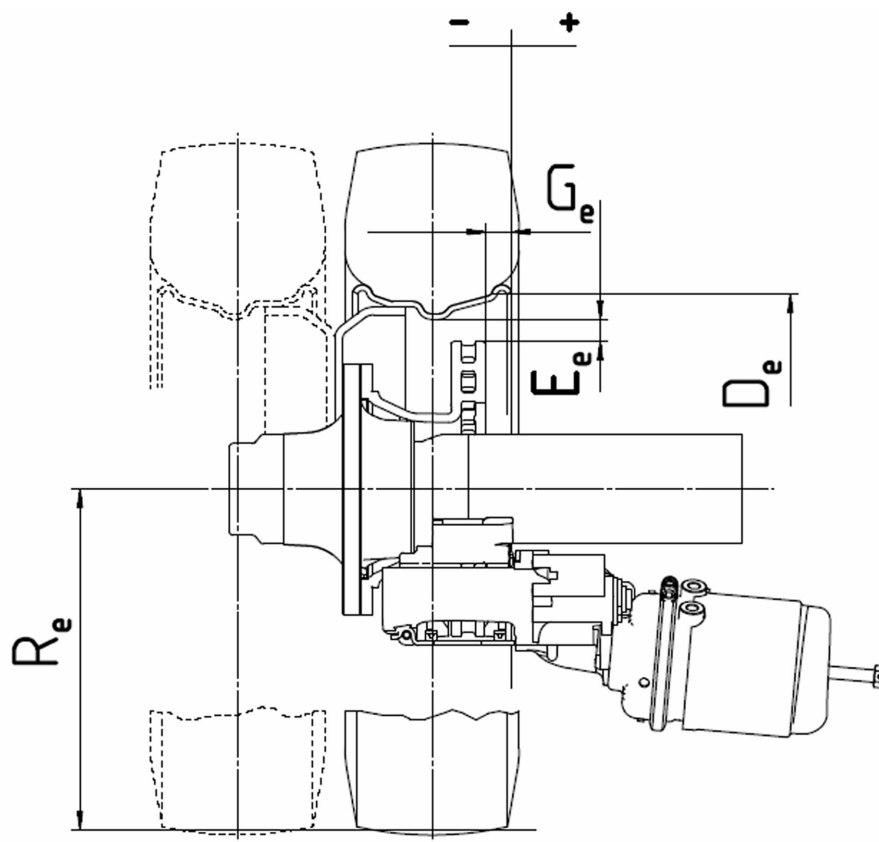


Figure 1B



3. BRAKE

3.1. General information

3.1.1. Make:

3.1.2. Manufacturer (name and address):

3.1.3. Type of brake (e.g. drum/disc):

3.1.3.1. Variant (e.g. S-cam, single wedge etc.):

3.1.4. Brake identifier: ID2-.....

3.1.5. Brake data according to the following figures 2A and 2B:

Figure 2A

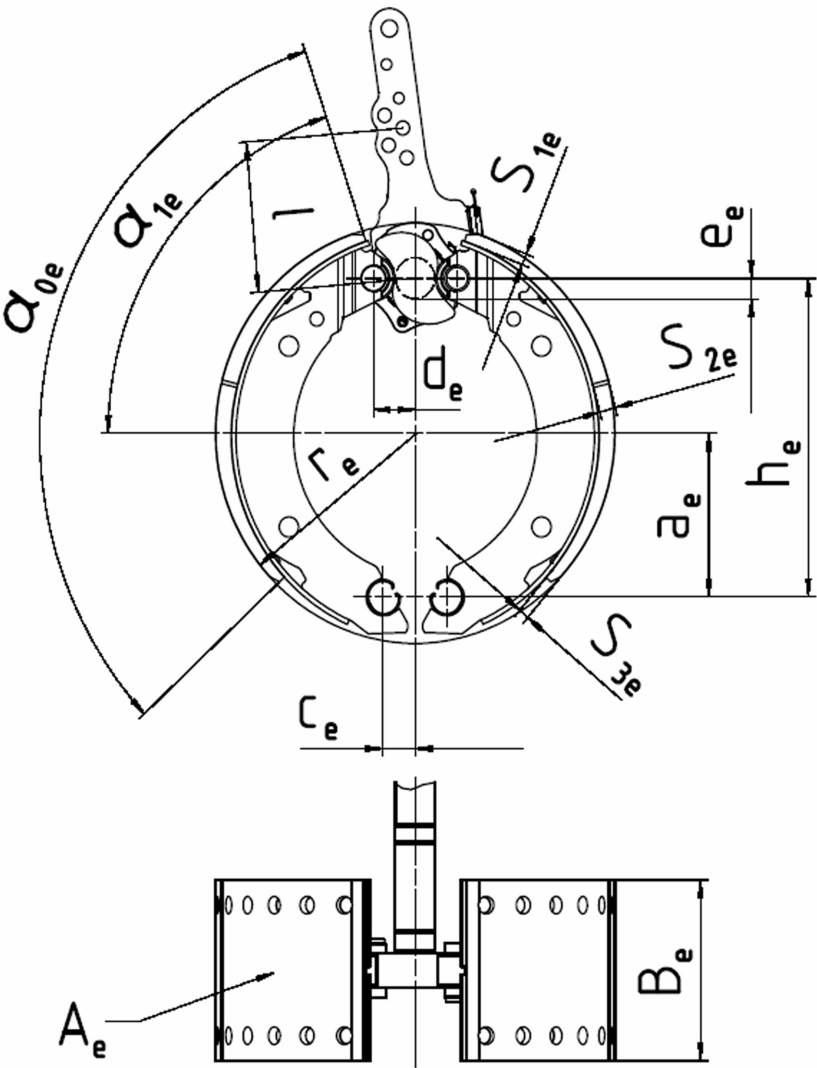
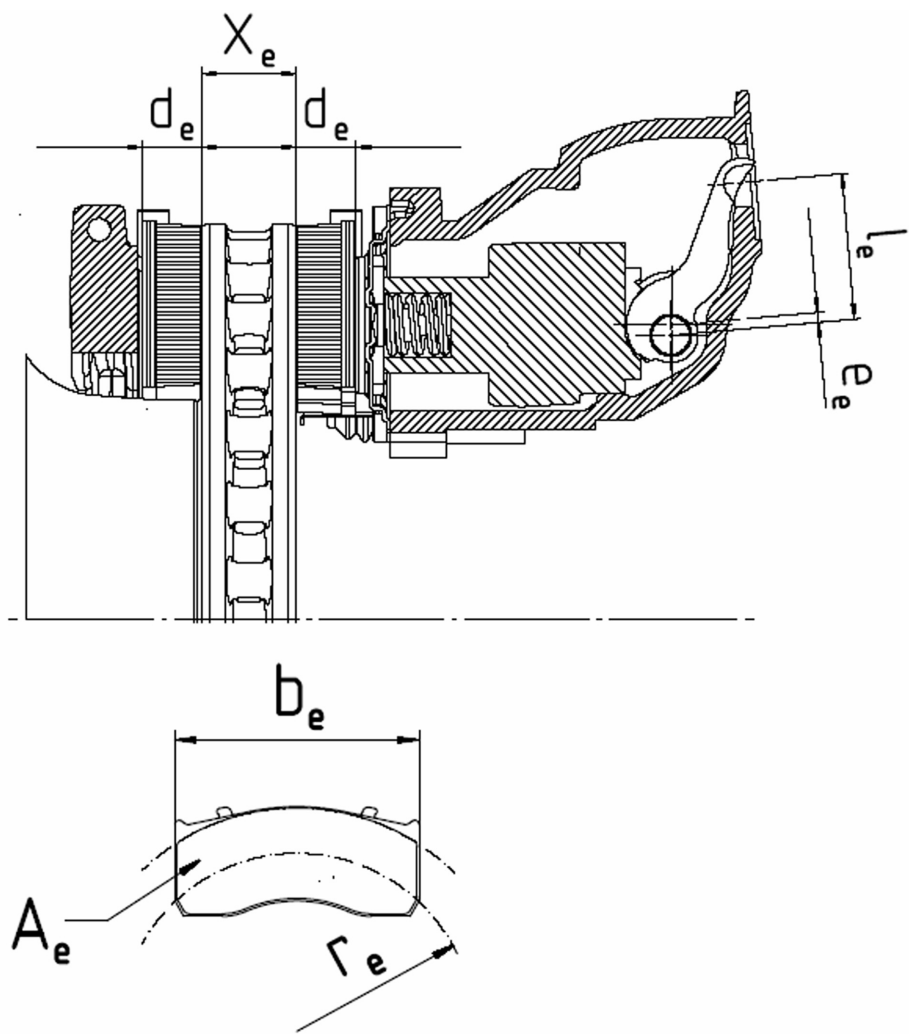


Figure 2B



x_e	a_e	h_e	c_e	d_e	e_e	α_{0e}	α_{1e}	b_e	r_e	A_e	S_{1e}	S_{2e}	S_{3e}
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)			(mm)	(mm)	(cm ²)	(mm)	(mm)	(mm)

- 3.2. Drum brake data
- 3.2.1. Brake adjustment device (external/integrated):
- 3.2.2. Declared maximum brake input torque C_{max} :Nm
- 3.2.3. Mechanical efficiency: η =
- 3.2.4. Declared brake input threshold torque $C_{0,dec}$:Nm
- 3.2.5. Effective length of the cam shaft: mm
- 3.3. Brake drum
- 3.3.1. Max diameter of friction surface (wear limit):mm
- 3.3.2. Base material:
- 3.3.3. Declared mass: kg
- 3.3.4. Nominal mass: kg

- 3.4. Brake lining
- 3.4.1. Manufacturer and address:
- 3.4.2. Make:
- 3.4.3. Type:
- 3.4.4. Identification (type identification on lining):
- 3.4.5. Minimum thickness (wear limit):mm
- 3.4.6. Method of attaching friction material to brake shoe:
- 3.4.6.1. Worst case of attachment (in the case of more than one):
- 3.5. Disc brake data
- 3.5.1. Connection type to the axle (axial, radial, integrated, etc.):
- 3.5.2. Brake adjustment device (external/integrated):
- 3.5.3. Max. actuation stroke: mm
- 3.5.4. Declared maximum input force Th_{Amax} :daN
- 3.5.4.1. $C_{max} = Th_{Amax} \cdot l_e$:Nm
- 3.5.5. Friction radius: $r_e =$ mm
- 3.5.6. Lever length: $l_e =$ mm
- 3.5.7. Input/output ratio (l_e/e_e): $i =$
- 3.5.8. Mechanical efficiency: $\eta =$
- 3.5.9. Declared brake input threshold force $Th_{A0,dec}$: N
- 3.5.9.1. $C_{0,dec} = Th_{A0,dec} \cdot l_e$:Nm
- 3.5.10. Minimum rotor thickness (wear limit): mm
- 3.6. Brake disc data
- 3.6.1. Disc type description:
- 3.6.2. Connection/mounting to the hub:
- 3.6.3. Ventilation (yes/no):
- 3.6.4. Declared mass: kg
- 3.6.5. Nominal mass: kg
- 3.6.6. Declared external diameter: mm
- 3.6.7. Minimum external diameter:mm
- 3.6.8. Inner diameter of friction ring: mm
- 3.6.9. Width of ventilation channel (if appl.): mm
- 3.6.10. Base material:
- 3.7. Brake pad data
- 3.7.1. Manufacturer and address:
- 3.7.2. Make:
- 3.7.3. Type:
- 3.7.4. Identification (type identification on pad back plate):
- 3.7.5. Minimum thickness (wear limit):mm
- 3.7.6. Method of attaching friction material to pad back plate:
- 3.7.6.1. Worst case of attachment (in the case of more than one):

Amendments to Annex 13

Annex 13, paragraph 4.3, amend to read:

‘4.3. In the event of a failure as defined in paragraph 4.1 above, the following requirements shall apply:

Motor vehicles: The residual braking performance shall be that prescribed for the vehicle in question in the event of a failure of part of the transmission of the service braking system as defined in paragraph 5.2.1.4 of this Regulation. This requirement shall not be construed as a departure from the requirements concerning secondary braking.

Trailers: The residual braking performance shall be that defined in paragraph 5.2.2.15.2 of this Regulation.’

Amendments to Annex 16

Annex 16, amend to read:

‘ANNEX 16

Compatibility between towing vehicles and trailers with respect to iso11992 data communications

1. GENERAL

- 1.1. The requirements of this Annex shall only apply to towing vehicles and trailers equipped with an electric control line as defined in paragraph 2.24 of the Regulation.
- 1.2. The ISO7638 connector provides a power supply for the braking system or anti-lock braking system of the trailer. In the case of vehicles equipped with an electric control line as defined in paragraph 2.24 of the Regulation this connector also provides a data communication interface via Pins 6 and 7 — see paragraph 5.1.3.6 of the Regulation.
- 1.3. This Annex defines requirements applicable to the towing vehicle and trailer with respect to the support of messages defined within ISO 11992-2:2003 including Amd.1:2007.
2. The parameters defined within ISO 11992-2:2003 including Amd.1:2007 that are transmitted by the electric control line shall be supported as follows:
 - 2.1. The following functions and associated messages are those specified within this Regulation that shall be supported by the towing vehicle or trailer as appropriate:

2.1.1. Messages transmitted from the towing vehicle to the trailer:

Function/Parameter	ISO 11992-2:2003 Reference	Regulation No 13 Reference
Service/secondary brake demand value	EBS11 Byte 3-4	Annex 10, paragraph 3.1.3.2
Two electrical circuits brake demand value	EBS12 Byte 3 Bit 1-2	Regulation No 13, paragraph 5.1.3.2
Pneumatic control line	EBS12 Byte 3 Bit 5-6	Regulation No 13, paragraph 5.1.3.2

2.1.2. Messages transmitted from the trailer to the towing vehicle:

Function/Parameter	ISO 11992-2:2003 Reference	Regulation No 13 Reference
VDC Active/passive	EBS21 Byte 2 Bit 1-2	Annex 21, paragraph 2.1.6
Vehicle electrical supply sufficient/insufficient	EBS22 Byte 2 Bit 1-2	Regulation No 13, paragraph 5.2.2.20
Red warning signal request	EBS22 Byte 2 Bit 3-4	Regulation No 13, paragraphs 5.2.2.15.2.1, 5.2.2.16 and 5.2.2.20
Supply line braking request	EBS22 Byte 4 Bit 3-4	Regulation No 13, paragraph 5.2.2.15.2
Stop lamps request	EBS22 Byte 4 Bit 5-6	Regulation No 13, paragraph 5.2.2.22.1
Vehicle pneumatic supply sufficient/insufficient	EBS23 Byte 1 Bit 7-8	Regulation No 13, paragraph 5.2.2.16

2.2. When the trailer transmits the following messages, the towing vehicle shall provide a warning to the driver:

Function/Parameter	ISO 11992-2:2003 Reference	Driver Warning Required
VDC Active/Passive ⁽¹⁾	EBS21 Byte 2 Bit 1-2	Annex 21, paragraph 2.1.6
Red warning signal request	EBS22 Byte 2 Bit 3-4	Regulation No 13, paragraph 5.2.1.29.2.1

⁽¹⁾ VDC (Vehicle Dynamic Control) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Vehicle Stability Function — see paragraph 2.34 of the Regulation.

2.3. The following messages defined in ISO 11992-2:2003 including Amd.1:2007 shall be supported by the towing vehicle or trailer:

2.3.1. Messages transmitted from the towing vehicle to the trailer:

No messages currently defined.

2.3.2. Messages transmitted from the trailer to the towing vehicle:

Function/Parameter	ISO 11992-2:2003 Reference
Vehicle service brake active/passive	EBS22 Byte 1, Bit 5-6
Braking via electric control line supported	EBS22 Byte 4, Bit 7-8
Geometric data index	EBS24 Byte 1
Geometric data index content	EBS24 Byte 2

2.4. The following messages shall be supported by the towing vehicle or trailer as appropriate when the vehicle is installed with a function associated with that parameter:

2.4.1. Messages transmitted from the towing vehicle to the trailer:

Function/Parameter	ISO 11992-2:2003 Reference
Vehicle type	EBS11 Byte 2, Bit 3-4
VDC (Vehicle Dynamic Control) Active/passive ⁽¹⁾	EBS11 Byte 2, Bit 5-6
Brake demand value for front or left side of vehicle	EBS11 Byte 7
Brake demand value for rear or right side of vehicle	EBS11 Byte 8
ROP (Roll-Over Protection) system enabled/disabled ⁽²⁾	EBS12 Byte 1, Bit 3-4
YC (Yaw Control) system enabled/disabled ⁽³⁾	EBS12 Byte 1, Bit 5-6
Enable/disable trailer ROP (Roll Over Protection)system ⁽²⁾	EBS12 Byte 2, Bit 1-2
Enable/disable trailer YC (Yaw Control) system ⁽³⁾	EBS12 Byte 2, Bit 3-4
Traction help request	RGE11 Byte 1, Bit 7-8
Lift axle 1 — position request	RGE11 Byte 2, Bit 1-2
Lift axle 2 — position request	RGE11 Byte 2, Bit 3-4
Steering axle locking request	RGE11 Byte 2, Bit 5-6
Seconds	TD11 Byte 1
Minutes	TD11 Byte 2
Hours	TD11 Byte 3
Months	TD11 Byte 4
Day	TD11 Byte 5
Year	TD11 Byte 6
Local minute offset	TD11 Byte 7
Local hour offset	TD11 Byte 8

⁽¹⁾ VDC (Vehicle Dynamic Control) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Vehicle Stability Function — see paragraph 2.34 of the Regulation.

⁽²⁾ ROP (Roll Over Protection) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Roll-Over Control — see paragraph 2.32.2.2 of the Regulation.

⁽³⁾ YC (Yaw Control) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Directional Control — see paragraph 2.32.2.1 of the Regulation.

2.4.2. Messages transmitted from the trailer to the towing vehicle:

Function/Parameter	ISO 11992-2:2003 Reference
Support of side or axle wise brake force distribution	EBS21 Byte 2, Bit 3-4
Wheel based vehicle speed	EBS21 Byte 3-4
Lateral acceleration	EBS21 Byte 8
Vehicle ABS active/passive	EBS22 Byte 1, Bit 1-2
Amber warning signal request	EBS22 Byte 2, Bit 5-6
Vehicle type	EBS22 Byte 3, Bit 5-6
Loading ramp approach assistance	EBS22 Byte 4, Bit 1-2
Axle load sum	EBS22 Byte 5-6
Tyre pressure sufficient/insufficient	EBS23 Byte 1, Bit 1-2
Brake lining sufficient/insufficient	EBS23 Byte 1, Bit 3-4
Brake temperature status	EBS23 Byte 1, Bit 5-6
Tyre/wheel identification (pressure)	EBS23 Byte 2
Tyre/wheel identification (lining)	EBS23 Byte 3
Tyre/wheel identification (temperature)	EBS23 Byte 4
Tyre pressure (actual tyre pressure)	EBS23 Byte 5
Brake lining	EBS23 Byte 6
Brake temperature	EBS23 Byte 7
Brake cylinder pressure first axle left wheel	EBS25 Byte 1
Brake cylinder pressure first axle right wheel	EBS25 Byte 2
Brake cylinder pressure second axle left wheel	EBS25 Byte 3
Brake cylinder pressure second axle right wheel	EBS25 Byte 4
Brake cylinder pressure third axle left wheel	EBS25 Byte 5
Brake cylinder pressure third axle right wheel	EBS25 Byte 6
ROP (Roll Over Protection) system enabled/disabled ⁽¹⁾	EBS25 Byte 7, Bit 1-2
YC (Yaw Control) system enabled/disabled ⁽²⁾	EBS25 Byte 7, Bit 3-4

Function/Parameter	ISO 11992-2:2003 Reference
Traction help	RGE21 Byte 1, Bit 5-6
Lift axle 1 position	RGE21 Byte 2, Bit 1-2
Lift axle 2 position	RGE21 Byte 2, Bit 3-4
Steering axle locking	RGE21 Byte 2, Bit 5-6
Tyre/wheel identification	RGE23 Byte 1
Tyre temperature	RGE23 Byte 2-3
Air leakage detection (Tyre)	RGE23 Byte 4-5
Tyre pressure threshold detection	RGE23 Byte 6, Bit 1-3

(¹) ROP (Roll-Over Protection) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Roll-Over Control — see paragraph 2.32.2.2 of the Regulation.

(²) YC (Yaw Control) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Directional Control — see paragraph 2.32.2.1 of the Regulation.

- 2.5. The support of all other messages defined within ISO 11992-2:2003 including Amd.1:2007 is optional for the towing vehicle and trailer.’

Amendments to Annex 17

Annex 17,

Add new paragraphs 3.2.2.6 and 3.2.2.7, to read:

‘3.2.2.6. Illumination of stop lamps

Simulate message EBS22 byte 4 bits 5 to 6 set to 00 and check that the stop lamps are not illuminated.

Simulate message EBS22 byte 4 bits 5 to 6 set to 01 and check that the stop lamps are illuminated.

3.2.2.7. Intervention of Trailer Stability Function

Simulate message EBS21 byte 2 bits 1 to 2 set to 00 and check that the driver warning defined in paragraph 2.1.6 of Annex 21 is not illuminated.

Simulate message EBS21 byte 2 bits 1 to 2 set to 01 and check that the driver warning defined in paragraph 2.1.6 of Annex 21 is illuminated.’Add a new paragraph 3.2.3.2, to read:

- ‘3.2.3.2. Paragraph 2.4.1 of Annex 16 defines additional messages that shall under specific circumstances be supported by the towing vehicle. Additional checks may be carried out to verify the status of supported messages to ensure the requirements of paragraph 5.1.3.6.2 of the Regulation are fulfilled.’

Add new paragraphs 4.2.2.4 to 4.2.2.6, to read:

‘4.2.2.4. Automatically commanded braking

In case the trailer includes a function where its operation results in an automatically commanded braking intervention, the following shall be checked:

If no automatically commanded braking intervention is generated, check that message EBS22 byte 4 bits 5 to 6 are set to 00.

Simulate an automatically commanded braking intervention, when the resulting deceleration is $\geq 0,7 \text{ m/sec}^2$, check that message EBS22 byte 4 bits 5 to 6 are set to 01.

4.2.2.5. Vehicle stability function

In the case of a trailer equipped with a vehicle stability function, the following checks shall be carried out:

When the vehicle stability function is inactive, check that message EBS21 byte 2 bits 1 to 2 are set to 00.

Simulate an intervention of the vehicle stability control function as specified in paragraph 2.2.4 of Annex 21 and check that message EBS21 byte 2 bits 1 to 2 are set to 01.

4.2.2.6. Support of the electric control line

Where the trailer braking system does not support braking via the electric control line check that message EBS22 byte 4 bits 7 to 8 are set to 00.

Where the trailer braking system supports the electric control line, check that message EBS22 byte 4 bits 7 to 8 are set to 01.'

Add a new paragraph 4.2.3.2, to read:

'4.2.3.2. Paragraph 2.4.2 of Annex 16 defines additional messages that shall under specific circumstances be supported by the trailer. Additional checks may be carried out to verify the status of supported messages to ensure the requirements of paragraph 5.1.3.6.2 of the Regulation are fulfilled.'

Amendments to Annex 19

Annex 19,

Add a new paragraph 1.1.5, to read:

'1.1.5. Vehicle stability function (refer to paragraph 6).'

Paragraph 2.2.3, for Appendix 7 read Appendix 9.

Paragraph 4.2.2, amend to read:

'4.2.2. The brake factor is determined by using the following formula:

$$B_F = \frac{\Delta \text{ Output torque}}{\Delta \text{ Input torque}}$$

and shall be verified for each of the lining or pad materials specified in paragraph 4.3.1.3.'

Paragraph 4.3.2.3, amend to read:

'4.3.2.3. The declared threshold torque $C_{0,dec}$ '

Add new paragraphs 6 to 6.6.1, to read:

'6. Vehicle stability function

6.1. General

6.1.1. This section defines a test procedure to determine the dynamic characteristics of a vehicle equipped with a vehicle stability function consisting of at least one of the following functions:

(a) directional control;

(b) roll-over control.

6.2. Information document

6.2.1. The system/vehicle manufacturer shall supply to the Technical Service an Information Document of the control function(s) for which performance verification is required. This document shall contain at least the information defined in Appendix 7 to this Annex.

- 6.3. Definition of test vehicle(s)
- 6.3.1. Based on the stability control function(s) and their application(s) defined in the manufacturer's information document the Technical Service shall carry out a performance verification. This may include one or more dynamic manoeuvres as defined in paragraph 2.2.3 of Annex 21 to this Regulation on a trailer(s) having up to three axles which is representative of the application(s) defined in paragraph 2.1 of the manufacturers information document.
- 6.3.1.1. When selecting the trailer(s) for evaluation, consideration shall also be given to the following:
- (a) Suspension type: for each suspension group, e.g. balanced pneumatic, a trailer of that specification shall be evaluated;
 - (b) Wheel base: wheel base shall not be a limiting factor;
 - (c) Brake type: approval shall be limited to trailers with S-cam or disc brakes but should other types become available, then comparative testing may be required;
 - (d) Braking system: the braking system of the trailer(s) to be evaluated shall comply with all of the relevant requirements of this Regulation.
- 6.4. Test schedule
- 6.4.1. To evaluate the vehicle stability control function the tests used shall be agreed between the system/vehicle manufacturer and the Technical Service and shall include conditions, appropriate to the function being evaluated, that would without the intervention of the stability control function result in loss of directional control or roll-over. The dynamic manoeuvres, test conditions and results shall be included in the test report.
- 6.5. Towing vehicle
- 6.5.1. The towing vehicle used for evaluating the performance of the vehicle (trailer) stability function shall have the necessary pneumatic and electrical connections and if the towing vehicle is equipped with a vehicle stability function as defined in paragraph 2.34 of this Regulation that function shall be disabled.
- 6.6. Test report
- 6.6.1. A test report shall be produced, the content of which shall be at least that defined in Appendix 8 to this Annex. Add a new Appendix 7 to Annex 19, to read:

'APPENDIX 7

Vehicle stability function information document

1. GENERAL
 - 1.1. Name of manufacturer
 - 1.2. System name
 - 1.3. System variations
 - 1.4. Control function (directional/roll-over/both) including an explanation of the basic function and/or philosophy of the control
 - 1.5. System configurations (where appropriate)
 - 1.6. System identification
2. APPLICATIONS
 - 2.1. List of trailer types and configurations for which approval is required

- 2.2. Schematic diagrams of the respective configurations installed on the trailers defined in item 2.1 above with consideration given to the following:
 - (a) Lift axles
 - (b) Steering axles
 - (c) Anti-lock braking configurations
- 2.3. Scope of application with respect to suspension type:
 - (a) Air suspension: any type of balanced "trailing arm" air suspension
 - (b) Other suspensions: individually identified by manufacturer, model and type (balanced/unbalanced)
- 2.4. Additional information (if applicable) to the application of the directional control and/or the roll-over control function(s)
3. COMPONENT DESCRIPTION
 - 3.1. Sensors external to the controller
 - (a) Function
 - (b) Limitations on the location of the sensors
 - (c) Identification, e.g. part numbers
 - 3.2. Controller(s)
 - (a) General description and function
 - (b) Identification e.g. part numbers
 - (c) Limitations on the location of the controller(s)
 - (d) Additional features
 - 3.3. Modulators
 - (a) General description and function
 - (b) Identification
 - (c) Limitations
 - 3.4. Electrical equipment
 - (a) Circuit diagrams
 - (b) Powering methods
 - 3.5. Pneumatic circuits

System schematics including anti-lock braking configurations associated with the trailer types defined in paragraph 6.2.1 of this Annex.
 - 3.6. Safety aspects of the electronic system in accordance with Annex 18 to this Regulation
 - 3.7. Electro-magnetic compatibility
 - 3.7.1. Documentation demonstrating compliance with Regulation No 10 including the 02 series of amendments.'

Add a new Appendix 8 to Annex 19, to read:

‘APPENDIX 8

Vehicle stability function test report

TEST REPORT No:

1. IDENTIFICATION

1.1. Manufacturer of the vehicle stability function (name and address):

1.2. System name/model:

1.3. Control function:

2. SYSTEM(S) AND INSTALLATIONS APPROVED

2.1. Anti-lock braking configurations (where appropriate):

2.2. Range of application (trailer type(s) and number of axles):

2.3. System identification:

2.4. Additional features:

3. TEST DATA AND RESULTS

3.1. Test vehicle data (including the specification and functionality of the towing vehicle):

3.2. Test surface information:

3.3. Additional Information:

3.4. Demonstrative tests/simulations used for the purpose of evaluating the directional control and the roll-over control as appropriate:

3.5. Test results:

3.6. Assessment in accordance with Annex 18 to this Regulation:

4. LIMITS OF INSTALLATION

4.1. Suspension type:

4.2. Brake type:

4.3. Location of components on the trailer:

4.4. Anti-lock braking configurations:

4.5. Other recommendations/limitations (e.g. lifting axles, steering axles, etc.):

5. ATTACHMENTS:

6. DATE OF TEST:

7. This test has been carried out and the results reported in accordance with Annex 19 to ECE Regulation No 13 as last amended by the ... series of amendments.

TECHNICAL SERVICE ⁽¹⁾ CONDUCTING THE TEST

Signed:Date:

8. APPROVAL AUTHORITY ⁽¹⁾

Signed:Date:

⁽¹⁾ To be signed by different persons even when the Technical Service and Approval Authority are the same or alternatively, a separate Approval Authority Authorisation issued with the report.’

Appendices 7 and 8, renumber as Appendices 9 and 10.

Amendments to Annex 20

Annex 20,

Paragraph 2.1.3, amend to read:

- ‘2.1.3. A documentation package that contains the relevant verification information including the relevant calculations, where appropriate, for the following:

Performance requirements	Annex 20 reference
Cold service braking performance	3
Parking brake performance	4
Automatic (emergency) brake performance	5
Failure of brake distribution system	6
Anti-lock braking	7
Vehicle stability function	8
Functional checks	9’

Add new paragraphs 8 to 8.2.1.4, to read:

- ‘8. Alternative procedure for demonstrating the performance of a trailer equipped with a vehicle stability function.
- 8.1. Evaluation of a trailer in accordance with paragraph 2 of Annex 21 to this Regulation may be waived at the time of trailer type approval provided that the vehicle stability function complies with the relevant requirements of Annex 19 to this Regulation.
- 8.2. Verification
- 8.2.1. Verification of components and installation
- The specification of the braking system, in which the stability control function is integrated and installed on the trailer to be type-approved shall be verified by satisfying each of the following criteria:

	Condition	Criteria
8.2.1.1.	(a) Sensor(s)	No change allowed
	(b) Controller(s)	No change allowed
	(c) Modulator(s)	No change allowed
8.2.1.2.	Trailer types as defined in the test report	No change allowed
8.2.1.3.	Installation configurations as defined in the test report	No change allowed
8.2.1.4.	For other limitations refer to paragraph 4 of the test report as described in Appendix 8 of Annex 19 to this Regulation.	No change allowed’

Paragraphs 8 to 8.1.7.1 (former), renumber as paragraphs 9 to 9.1.7.1.

Paragraphs 8.1.8 and 8.1.8.1 (former), renumber as paragraph 9.1.9 and 9.1.9.1.

Add new paragraphs 9.1.8 and 9.1.8.1, to read:

- ‘9.1.8. Vehicle stability function
- 9.1.8.1. For practical reasons verification of the vehicle stability function shall be limited to an installation check as defined in paragraph 8.2 above and observation of the correct warning signal sequence to ensure no faults are present.’

Add a new Annex 21, to read (including its Appendices 1 to 3):**'ANNEX 21****Special requirements for vehicles equipped with a vehicle stability function****1. GENERAL**

This annex defines the special requirements for vehicles equipped with a vehicle stability function, pursuant to paragraphs 5.2.1.32 and 5.2.2.23 of this Regulation.

2. REQUIREMENTS**2.1. Power-driven vehicles****2.1.1. Where a vehicle is equipped with a vehicle stability function as defined in paragraph 2.34 of this Regulation, the following shall apply:**

In the case of directional control the function shall have the ability to automatically control individually the speed of the left and right wheels on each axle or an axle of each axle group ⁽¹⁾ by selective braking based on the evaluation of actual vehicle behaviour in comparison with a determination of vehicle behaviour demanded by the driver ⁽²⁾.

In the case of roll-over control the function shall have the ability to automatically control the wheel speeds on at least two wheels of each axle or axle group ⁽¹⁾ by selective braking or automatically commanded braking based on the evaluation of actual vehicle behaviour that may lead to vehicle roll-over ⁽²⁾.

In both cases, the function is not required:

- (a) When the vehicle speed is below 20 km/h;
- (b) Until the initial start-up self test and plausibility checks have been completed;
- (c) When the vehicle is being driven in reverse.

2.1.2. To realise the functionality defined above a vehicle stability function shall include, in addition to selective braking and/or automatically commanded braking, at least the following:

- (a) The ability to control engine power output;
- (b) In the case of directional control: The determination of actual vehicle behaviour from values of yaw rate, lateral acceleration, wheel speeds, and from the driver's control inputs to the braking and steering systems and to the engine. Only on-board generated information shall be used. If these values are not directly measured, the evidence of the appropriate correlation with directly measured values under all driving conditions (e.g. including driving in a tunnel) shall be shown to the technical service at the time of type approval;
- (c) In the case of roll-over control: The determination of actual vehicle behaviour from values of the vertical force on the tyre(s) (or at least lateral acceleration and wheel speeds) and from the driver's control inputs to the braking system and to the engine. Only on-board generated information shall be used. If these values are not directly measured, the evidence of the appropriate correlation with directly measured values under all driving conditions (e.g. including driving in a tunnel) shall be shown to the technical service at the time of type approval;
- (d) In the case of a towing vehicle equipped according to paragraph 5.1.3.1 of this Regulation: The ability to apply the service brakes of the trailer via the respective control line(s) independently of the driver.

- 2.1.3. The vehicle stability function shall be demonstrated to the Technical Service by dynamic manoeuvres on one vehicle. This may be realized by a comparison of results obtained with the vehicle stability function enabled and disabled for a given load condition. As an alternative to carrying-out dynamic manoeuvres for other vehicles and other load conditions, fitted with the same vehicle stability system, the results from actual vehicle tests or computer simulations may be submitted.

The use of the simulator is defined in Appendix 1 to this Annex.

The specification and validation of the simulator is defined in Appendix 2 to this Annex.

Until unified test procedures are agreed, the method by which this demonstration is carried out shall be agreed between the vehicle manufacturer and the Technical Service and shall include the critical conditions of directional control and roll-over control as appropriate to the vehicle stability function installed on the vehicle with the method of demonstration and results being appended to the type approval report. This may be carried-out other than at the time of type approval.

As a means of demonstrating the vehicle stability function any of the following dynamic manoeuvres shall be used ⁽³⁾:

Directional control	Roll-over control
Reducing radius test	Steady state circular test
Step steer input test	J-turn
Sine with dwell	
J-turn	
μ -split single lane change	
Double lane change	
Reversed steering test or "fish hook" test	
Asymmetrical one period sine steer or pulse steer input test	

To demonstrate repeatability the vehicle will be subject to a second demonstration using the selected manoeuvre(s).

- 2.1.4. Interventions of the vehicle stability function shall be indicated to the driver by a specific optical warning signal. The indication shall be present as long as the vehicle stability function is in an intervention mode. The warning signals specified in paragraph 5.2.1.29 of this Regulation shall not be used for this purpose.

Interventions of the vehicle stability function used in any learning process to determine the vehicle operational characteristics shall not generate the above signal.

The signal shall be visible to the driver, even in daylight, such that the driver can easily verify the satisfactory condition of the signal without leaving the driver's seat.

- 2.1.5. A vehicle stability function failure or defect shall be detected and indicated to the driver by the specific yellow optical warning signal referred to in paragraph 5.2.1.29.1.2 of this Regulation.

The warning signal shall be constant and remain displayed as long as the failure or defect persists and the ignition (start) switch is in the “on” (run) position.

- 2.1.6. In the case of a power-driven vehicle equipped with an electric control line and electrically connected to a trailer with an electric control line the driver shall be warned by a specific optical warning signal whenever the trailer provides the information “VDC Active” via the data communications part of the electric control line. The optical signal defined in paragraph 2.1.4 above may be used for this purpose.

2.2. Trailers

- 2.2.1. Where a trailer is equipped with a vehicle stability function as defined in paragraph 2.34 of this Regulation, the following shall apply:

In the case of directional control the function shall have the ability to automatically control individually the speed of the left and right wheels on each axle or an axle of each axle group ⁽¹⁾ by selective braking based on the evaluation of actual trailer behaviour in comparison with a determination of the relative behaviour of the towing vehicle ⁽²⁾.

In the case of roll-over control the function shall have the ability to automatically control the wheel speeds on at least two wheels of each axle or axle group ⁽¹⁾ by selective braking or automatically commanded braking based on the evaluation of actual trailer behaviour that may lead to roll-over ⁽²⁾.

- 2.2.2. To realise the functionality defined above a vehicle stability function shall include, in addition to automatically commanded braking and where appropriate selective braking, at least the following:

(a) The determination of actual trailer behaviour from values of the vertical force on the tyre(s), or at least lateral acceleration and wheel speeds. Only on-board generated information shall be used. If these values are not directly measured, the evidence of the appropriate correlation with directly measured values under all driving conditions (e.g. including driving in a tunnel) shall be shown to the technical service at the time of type approval.

- 2.2.3. The vehicle stability function shall be demonstrated to the Technical Service by dynamic manoeuvres on one vehicle. This may be done by a comparison of results obtained with the vehicle stability function enabled and disabled for a given load condition. As an alternative to carrying-out dynamic manoeuvres for other vehicles and other load conditions, fitted with the same vehicle stability system, the results from actual vehicle tests or computer simulations may be submitted.

The use of the simulator is defined in Appendix 1 to this Annex.

The specification and validation of the simulator is defined in Appendix 2 to this Annex.

Until unified test procedures are agreed, the method by which this demonstration is carried out shall be agreed between the trailer manufacturer and the Technical Service and shall include the critical conditions of roll-over control and directional control as appropriate to the vehicle stability function installed on the trailer with the method of demonstration and results being appended to the type approval report. This may be carried-out other than at the time of type approval.

As a means of demonstrating the vehicle stability function any of the following dynamic manoeuvres shall be used ⁽³⁾:

Directional control	Roll-over control
Reducing radius test	Steady state circular test
Step steer input test	J-turn
Sine with dwell	
J-turn	
μ-split single lane change	
Double lane change	
Reversed steering test or "fish hook" test	
Asymmetrical one period sine steer or pulse steer input test	

To demonstrate repeatability the vehicle will be subject to a second demonstration using the selected manoeuvre(s).

- 2.2.4. Trailers equipped with an electric control line, when electrically connected to a towing vehicle with an electric control line, shall provide the information "VDC active" via the data communications part of the electric control line when the vehicle stability function is in an intervention mode. Interventions of the vehicle stability function used in any learning process to determine the trailer operational characteristics shall not generate the above information.
- 2.2.5. To maximise the performance of trailers that utilise "select-low" such trailers are permitted to change control mode to "select-high" during an intervention of the "Vehicle Stability Function".

- ⁽¹⁾ In the case of multiple axles, where the spread between one axle and its adjacent axle is greater than 2 m, each individual axle shall be considered as an independent axle group.
- ⁽²⁾ Additional interaction with other vehicle systems or components is allowed. Where these systems or components are subject to special regulations, such interaction shall comply with the requirements of those regulations, e.g. interaction with the steering system shall comply with the requirements set out in Regulation No 79 for corrective steering.
- ⁽³⁾ Should the use of any of the above defined manoeuvres not result in loss of directional control or roll-over as appropriate an alternative manoeuvre may be used in agreement with the Technical Service.

APPENDIX 1

Use of the dynamic stability simulation

The effectiveness of the directional and/or roll-over stability control function of power-driven vehicles and trailers of categories M, N and O, may be determined by computer simulation.

1. USE OF THE SIMULATION

- 1.1 The vehicle stability function shall be demonstrated by the vehicle manufacturer to the Type Approval Authority or Technical Service with the same dynamic manoeuvre(s) as for the practical demonstration in paragraph 2.1.3 or 2.2.3 of Annex 21.
- 1.2 The simulation shall be a means whereby the vehicle stability performance may be demonstrated with the vehicle stability function enabled or disabled, and in the laden and unladen conditions.
- 1.3 The simulations shall be carried out with a validated modelling and simulation tool. The verification shall be carried out using the same manoeuvre(s) as defined in paragraph 1.1 above.
- The method by which the simulation tool is validated is given in Annex 21, Appendix 2.

APPENDIX 2

Dynamic stability simulation tool and its validation

1. SPECIFICATION OF THE SIMULATION TOOL
 - 1.1. The simulation method shall take into account the main factors which influence the directional and roll motion of the vehicle. A typical model may include the following vehicle parameters in an explicit or implicit form:
 - (a) axle/wheel;
 - (b) suspension;
 - (c) tyre;
 - (d) chassis/vehicle body;
 - (e) power train/driveline, if applicable;
 - (f) brake system;
 - (g) payload.
 - 1.2. The Vehicle Stability Function shall be added to the simulation model by means of:
 - (a) a subsystem (software model) of the simulation tool; or
 - (b) the electronic control box in a hardware-in-the-loop configuration.
 - 1.3. In the case of a trailer, the simulation shall be carried out with the trailer coupled to a representative towing vehicle.
 - 1.4. Vehicle loading condition
 - 1.4.1. The simulator shall be able to take into account the laden and unladen conditions.
 - 1.4.2. The load shall be considered to be a fixed load with properties (mass, mass distribution and maximum recommended height of the centre of gravity) specified by the manufacturer.
2. VALIDATION OF THE SIMULATION TOOL
 - 2.1. The validity of the applied modelling and simulation tool shall be verified by means of comparisons with a practical vehicle test(s). The test(s) utilised for the validation shall be those which, without control action, would result in loss of directional control (under-steer and over-steer) or roll-over control as appropriate to the functionality of the stability control function installed on a representative vehicle.

During the test(s) the following motion variables, as appropriate, shall be recorded or calculated in accordance with ISO 15037 Part 1:2005: General conditions for passenger cars or Part 2:2002: General conditions for heavy vehicles and buses (depending on the vehicle category):

 - (a) yaw velocity;
 - (b) lateral acceleration;
 - (c) wheel load or wheel lift;
 - (d) forward velocity;
 - (e) driver input.

- 2.2. The objective is to show that the simulated vehicle behaviour and operation of the vehicle stability function is comparable with that seen in practical vehicle tests.
- 2.3. The simulator shall be deemed to be validated when its output is comparable to the practical test results produced by a given vehicle type during the selected manoeuvre(s) from those defined with paragraph 2.1.3 or 2.2.3 of Annex 21, as appropriate.

In the case of the steady state circular test the under-steer gradient shall be the means of making the comparison.

In the case of a dynamic manoeuvre, the relationship of activation and sequence of the vehicle stability function in the simulation and in the practical vehicle test shall be the means of making the comparison.
- 2.4. The physical parameters that are different between the reference vehicle and simulated vehicle configurations shall be modified accordingly in the simulation.
- 2.5. A simulator test report shall be produced, a model of which is defined in Appendix 3 of this Annex, and a copy attached to the vehicle approval report.

APPENDIX 3

Vehicle stability function simulation tool test report

TEST REPORT No:

1. IDENTIFICATION
 - 1.1. Name and address of the simulation tool manufacturer
 - 1.2. Simulation tool identification: name/model/number (hardware and software)
2. SCOPE OF APPLICATION
 - 2.1. Vehicle type: (e.g. truck, tractor, bus, semi-trailer, centre-axle trailer, full trailer)
 - 2.2. Vehicle configuration: (e.g. 4 × 2, 4 × 4, 6 × 2, 6 × 4, 6 × 6)
 - 2.3. Limiting factors: (e.g. mechanical suspension only)
 - 2.4. Manoeuvre(s) for which the simulator has been validated:
3. VERIFYING VEHICLE TEST(S)
 - 3.1. Description of vehicle(s) including the towing vehicle in case of trailer testing:
 - 3.1.1. Vehicle(s) identification: make/model/VIN
 - 3.1.1.1. Non-standard fitments:
 - 3.1.1.2. Vehicle description, including axle configuration/suspension/wheels, engine and drive line, braking system(s) and vehicle stability function content (directional control/roll-over control), steering system, with name/model/number identification:
 - 3.1.1.3. Vehicle data used in the simulation (explicit):
 - 3.2. Description of test(s) including location(s), road/test area surface conditions, temperature and date(s):

3.3. Results laden and unladen with the vehicle stability function switched on and off, including the motion variables referred to in Annex 21, Appendix 2, paragraph 2.1 as appropriate:

4. SIMULATION RESULTS

4.1. Vehicle parameters and the values used in the simulation that are not taken from the actual test vehicle (implicit):

4.2. Results laden and unladen with the vehicle stability function switched on and off for each test conducted under paragraph 3.2 of this Appendix, including the motion variables referred to in Annex 21, Appendix 2, paragraph 2.1 as appropriate:

5. This test has been carried out and the results reported in accordance with Appendix 2 of Annex 21 to ECE Regulation No 13 as last amended by the ... series of amendments.

Technical Service conducting the test ⁽¹⁾:

Signed: Date:

Approval Authority ⁽¹⁾:

Signed: Date:

⁽¹⁾ To be signed by different persons if the Technical Service and the Approval Authority is the same organisation.'

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