DRAFT No.

21295

LAMPS FOR ROAD VEHICLES – PERFORMANCE REQUIREMENTS

SAUDI ARABIAN STANDARDS ORGANIZATION

Foreword

The Saudi Arabian Standards Organization (SASO) has adopted the International standard No. IEC 60810:2003+A1:2008 "LAMPS FOR ROAD VEHICLES – PERFORMANCE REQUIREMENTS ". The text of this international standard has been translated into Arabic so as to be approved as a Saudi standard without introducing any technical modification.

CONTENTS

LAMPS FOR ROAD VEHICLES – PERFORMANCE REQUIREMENTS

1 Scope

This International Standard is applicable to replaceable lamps (filament lamps and discharge lamps) to be used in headlamps, fog-lamps and signalling lamps for road vehicles. It is especially applicable to those lamps which are listed in IEC 60809. However, the standard may also be used for other lamps falling under the scope of this standard, as well as for future developments, e.g. such where the light is produced by light emitting diodes (LED).

It specifies requirements and test methods for the measurement of performance characteristics such as lamp life, lumen maintenance, torsion strength, glass bulb strength and resistance to vibration and shock. Moreover, information on temperature limits, maximum lamp outlines and maximum tolerable voltage surges is given for the guidance of lighting and electrical equipment design.

For some of the requirements given in this standard, reference is made to data given in tables. For lamps not listed in such tables, the relevant data are supplied by the lamp manufacturer or responsible vendor.

The performance requirements are additional to the basic requirements specified in IEC 60809. They are, however, not intended to be used by authorities for legal type-approval purposes.

NOTE In the various vocabularies and standards, different terms are used for "incandescent lamp" (IEV 845-07-04) and "discharge lamp" (IEV 845-07-17). In this standard, "filament lamp" and "discharge lamp" are used. However, where only “lamp” is written both types are meant, unless the context clearly shows that it applies to one type only.

2 Normative references

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

IEC 60050(845):1987, *International Electrotechnical Vocabulary (IEV) – Chapter 845: Lighting*

IEC 60068-2-6:1995, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal) – Basic safety publication*

IEC 60068-2-47:1999, *Environmental testing – Part 2-47: Test methods – Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

IEC 60809, *Lamps for road vehicles – Dimensional, electrical and luminous requirements*

ISO 5344:1980, *Electrodynamic test equipment for generating vibration – Methods of describing equipment characteristics*

3 . Terms and definitions

For the purpose of this document, the following definitions apply, in addition to the definitions in IEC 60050(845) and IEC 60809.

3.1 life

total time (expressed in hours) during which a lamp has been operated before it becomes useless. For filament lamps, it is considered to be so according to one of the following criteria:

a) the end of life is the time when the filament fails;

b) the life of a dual-filament lamp is the time until either filament fails, if the lamp is tested in a switching cycle involving alternative operation of both filaments

3.2 characteristic life *T*

constant of the Weibull distribution indicating the time up to which 63,2 % of a number of tested lamps of the same type have ended their individual lives

3.3 life B3

constant of the Weibull distribution indicating the time during which 3 % of a number of the tested lamps of the same type have reached the end of their individual lives

3.4 lumen maintenance

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

3.5 initial luminous flux

luminous flux of a lamp measured after the ageing specified in Annex C of IEC 60809 for filament lamps or in Annex D of this standard for discharge lamps

3.6 rated value

value of a characteristic specified for operation of a lamp at test voltage and/or other specified conditions

3.7 pinch temperature limit

maximum admissible pinch temperature to ensure satisfactory lamp performance in service

3.8 solder temperature limit

maximum admissible solder temperature to ensure satisfactory lamp performance in service

3.9 maximum lamp outline

contour limiting the space to be reserved for the lamp in the relevant equipment

3.10 heavy-duty lamp

lamp declared as such, by the manufacturer or responsible vendor, which shall comply with the heavy-duty test conditions specified in Table B.2 of this standard in addition to the requirements specified in IEC 60809

4 Requirements and test conditions for filament lamps

4.1 Basic function and interchangeability

Filament lamps shall comply with IEC 60809.

4.2 Torsion strength

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

Compliance is checked before and after the life test by submitting the filament lamp to the following torque values:

filament lamps with bayonet caps

– with 9 mm shell-diameter: 0,3 Nm*;

– with 15 mm shell-diameter: 1,5 Nm*;

– with 20 mm shell-diameter: 3,0 Nm*;

filament lamps with screw caps

– with 10 mm shell-diameter: 0,8 Nm*.

The torque shall not be applied suddenly but shall be increased progressively from 0 to the specified amount.

Values are based on a non-compliance level of 1 %.

4.3 Characteristic life *T*

The life *T* measured on a test quantity of at least 20 filament lamps shall be at least 96 % of the rated value, given in Table 3.

Compliance is checked by life tests as prescribed in Annex A.

4.4 Life B3

The life B3 shall not be less than the rated value given in Table 3.

Compliance is checked by life tests as prescribed in Annex A.

The number of filament lamps failing before the required time shall not exceed the values in Table 1.

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* Under consideration.

Table 1 – Conditions of compliance for life B3

Number of filament lamps tested	Acceptance number
23 to 35	2
36 to 48	3
49 to 60	4
61 to 74	5
75 to 92	6

4.5 Lumen maintenance

The lumen maintenance shall be not less than the rated value given in Table 4. This value is based on a non-compliance level of 10 %.

4.6 Resistance to vibration and shock

In the event of service life being influenced by vibration or shock, the test methods and schedules detailed in Annex B shall be used to assess the performance.

The filament lamps are deemed to have satisfactorily completed the wideband or narrowband random vibration test as described in Annex B, if they continue to function during and after the test.

The number of filament lamps failing one of the tests shall not exceed the values in Table 2 (values are based on the AQL of 4 %).

Table 2 – Conditions of compliance for the vibration test

Number of filament lamps tested	Acceptance number
14 to 20	2
21 to 32	3
33 to 41	4
42 to 50	5
51 to 65	6

4.7 Glass-bulb strength

In the event of bulbs being impaired by mechanical handling for their assembly in equipment, the test methods and schedules defined in Annex C shall be used to assess the performance. The bulbs have to withstand the specified compression strength.

5 Filament lamp data

5.1 Rated life and lumen-maintenance values for road vehicle filament lamps tested under conditions as prescribed in Annex A

Table 3 – Rated life values for continuous operation

Filament lamp Data sheet Nos.	Type	12 V			24 V		
	Category	Test V	B3 h	*T* h	Test V	B3 h	*T* h
60809-IEC-2110	R2	13,2	90	250	28,0	90	250
60809-IEC-2120	H4	13,2	350	700	28,0	180[a]	500[a]
60809-IEC-2125	H6	14,0	(Under consideration)	300	–	–	–
60809-IEC-2305	H5	14,0	(Under consideration)	100	–	–	–
60809-IEC-2310	H1	13,2	150	400	28,0	90[a]	250[a]
60809-IEC-2320	H2	13,2	90	250	28,0	90	250
60809-IEC-2330	H3	13,2	150	400	28,0	90[a]	250[a]
60809-IEC-3110	P21/5W	13,5	60[b] 600[c]	160[b] 1 600[c]	28,0	60[b] 600[c]	160[b] 1 600[c]
60809-IEC-3120	P21/4W	13,5	60[b] 600[c]	160[b] 1 600[c]	28,0	60[b] 600[c]	160[b] 1 600[c]
60809-IEC-3310	P21W	13,5	120	320	28,0	60[a]	160[a]
60809-IEC-3320	R5W	13,5	100	300	28,0	80[a]	225[a]
60809-IEC-3330	R10W	13,5	100	300	28,0	80[a]	225[a]
60809-IEC-3340	T4W	13,5	300	750	28,0	120[a]	350[a]
60809-IEC-4110	C5W	13,5	350	750	28,0	120[a]	350[a]
60809-IEC-4120	C21W	13,5	40	110	28,0	–	–
60809-IEC-4310	W3W	13,5	500	1 500	28,0	400[a]	1 100[a]
60809-IEC-4320	W5W	13,5	200	500	28,0	120[a]	350[a]

NOTE 1 The values indicated are minimum requirements. Depending on some particular customers' specifications, different values may be obtained, i.e. shorter life/higher luminous flux or longer life/lower lumen maintenance. This has to be negotiated between filament lamp manufacturers and their customers.

[a] Extended values are under consideration.

[b] High-wattage filament.

[c] Low-wattage filament.

Table 4 – Rated lumen-maintenance values for continuous operation

Filament lamp Data sheet Nos.	Type	12 V			24 V		
	Category	Test V	Lumen maintenance h	%	Test V	Lumen maintenance h	%
60809-IEC-2110	R2	13,2	55[c] 110[d]	85 70	28,0 28,0	55[c] 110[d]	85 70
60809-IEC-2120	H4	13,2	110[c] 225[d]	85 85	28,0	110[c] 225[d]	85 85
60809-IEC-2125	H6	14,0	75[c] 150[d]	85 80	–	–	–
60809-IEC-2305	H5	14,0	75	85	–	–	–
60809-IEC-2310	H1	13,2	170	90	28,0	170	90
60809-IEC-2320	H2	13,2	170	90	28,0	170	90
60809-IEC-2330	H3	13,2	170	90	28,0	170	90
60809-IEC-3110	P21/5W	13,5	110[a] 750[b]	70 70	28,0	110[a] 750[b]	70 70
60809-IEC-3120	P21/4W	13,5	110[a] 750[b]	70 70	28,0	(Under consideration) (Under consideration)	(Under consideration) (Under consideration)
60809-IEC-3310	P21W	13,5	110	70	28,0	110	70
60809-IEC-3320	R5W	13,5	150	70	28,0	150	70
60809-IEC-3330	R10W	13,5	150	70	28,0	150	70
60809-IEC-3340	T4W	13,5	225	70	28,0	225	70
60809-IEC-4110	C5W	13,5	225	60	28,0	225	60
60809-IEC-4120	C21W	13,5	75	60	–	–	–
60809-IEC-4310	W3W	13,5	750	60	28,0	750	60
60809-IEC-4320	W5W	13,5	225	60	28,0	225	60

NOTE 1 The values indicated are minimum requirements. Depending on some particular customers' specifications, different values may be obtained, i.e. shorter life/higher luminous flux or longer life/lower lumen maintenance. This has to be negotiated between filament lamp manufacturers and their customers.

NOTE 2 Lumen-maintenance values for extended operation times are under consideration.

[a] High-wattage filament.

[b] Low-wattage filament.

[c] Main or upper beam filament.

[d] Dipped or lower beam filament.

6 Requirements and test conditions for discharge lamps

6.1 Basic function and interchangeability

Discharge lamps shall comply with the technical requirements of IEC 60809.

6.2 Mechanical strength

6.2.1 Bulb-to-cap connection

The bulb shall be strongly secured to the cap. Compliance is checked by means of the bulb deflection test conducted in accordance with Annex E.

6.2.2 Cable-to-cap connection (if any)

If the cable has a fixed connection to the cap, it shall withstand a pulling force of 60 N. The force shall be applied in the direction of the (straight) cable.

6.3 Characteristic life *T*

For the D1S, D2S, D1R and D2R discharge lamps, the life *T* measured on a test quantity of at least 20 lamps shall be not less than the value declared by the manufacturer, which shall be at least 3 000 h. Compliance is checked by tests as prescribed in Annex D.

6.4 Life B3

For the D1S, D2S, D1R and D2R discharge lamps, the life B3 measured on a test quantity of at least 20 lamps shall be not less than the value declared by the manufacturer, which shall be at least 1 500 h. Compliance is checked by tests as prescribed in Annex D.

6.5 Lumen maintenance

For the D1S, D2S, D1R and D2R discharge lamps, the lumen maintenance shall be at least 60 % of the initial luminous flux. Compliance is checked by tests prescribed in Annex D.

Values are based on a non-compliance level of 10 %.

6.6 Resistance to vibration and shock

In the event of service life being influenced by vibration and shock, the test methods and schedules in Annex B shall be used to assess the performance.

The discharge lamps are deemed to have satisfactorily completed the wideband or narrowband random vibration test as described in Annex B, if they continue to function during and after the test. Moreover, the position of the electrodes shall comply with the dimensional requirements as prescribed in the relevant standard.

Values are based on a non-compliance level of 4 %.

NOTE It is necessary to take care to protect service employees. See the note to Clause D.3.

6.7 Discharge lamps with integrated starting device

For discharge lamps of category D1S and D1R, the starting device may be built into the cap of the lamp. The total weight of the lamp shall not exceed 120 g. Information for ballast design is given in Annex G.

Annex A
(normative)

Life test conditions for filament lamps

A.1 Ageing

Filament lamps shall be aged at their test voltage for approximately 1 h. For dual-filament lamps, each filament shall be aged separately. Filament lamps which fail during the ageing period shall be omitted from the test results.

A.2 Test voltage

Measurements shall be carried out at the test voltage specified in Clause 5 of this standard which shall be a stable d.c. or a.c. voltage with a frequency between 40 Hz and 60 Hz.

NOTE The test voltage is deemed to be stable when the momentary fluctuations do not exceed 1 % and the deviation of the average over the test period does not exceed 0,5 % of the specified value.

A.3 Operating position

Filament lamps shall be operated on a vibration-free test rack with both lamp axis and filament(s) horizontal. In the special case of double-filament lamps which include a shield, this shall be under the dipped or lower-beam filament (H-H line horizontal). In the case of filament lamps with an axial filament, the longer filament support shall be positioned above the filament.

A.4 Switching cycle

A.4.1 Single-filament lamps

A.4.1.1 Filament lamps for continuous operation

Filament lamps shall be switched off twice daily for periods of not less than 15 min, such periods not being considered as part of the life.

A.4.1.2 Filament lamps for intermittent operation

Filament lamps for intermittent operation as used in stop-lamps and flashing direction indicators shall be operated in the following switching cycle:

- 15 s on for intermittent (flashing) operation;
- 15 s off;
- flashing frequency: 90/min;
- on/off ratio 1:1.

The whole flashing operation time is considered as life.

A.4.2 Dual-filament lamps for headlamps

The filaments shall be operated alternately according to the following cycle and starting with the lower beam filament:

– dipped or lower-beam filament: 15 h on/45 min off;

– main or upper-beam filament: 7,5 h on/45 min off.

The end of the life is determined by failure of either filament.

The off periods are not considered as part of the life.

NOTE The life of the lower-beam filament represents two-thirds of the total life, the life of the upper-beam filament one-third.

A.4.3 Dual-filament lamps for light signalling equipment

Life testing shall be carried out for each filament separately. Life testing of the low-wattage filament shall be carried out on filament lamps other than those used for life testing of the high-wattage filament.

A.4.3.1 Filaments for continuous operation

The switching cycle shall be as specified in A.4.1.1.

A.4.3.2 Filaments for intermittent operation

The switching cycle shall be as specified in A.4.1.2.

A.5 Lumen maintenance

Tests may be interrupted for determination of the lumen maintenance.

Annex B
(normative)

Vibration tests

B.1 General

These tests are designed to ensure that lamps satisfactorily completing this schedule will not be adversely affected by shock and vibration in normal service.

Two levels of test are specified which are referred to as "standard test" and "heavy-duty test" and the appropriate level must be selected for the intended vehicle usage.

The acceleration levels and frequency spectra used in these tests are based on extensive investigations into the characteristics experienced at lamp mounting positions on a wide range of vehicles and in normal service conditions.

Although the standard test relates to normal vehicle service conditions, investigations have shown that the more arduous conditions given by heavy goods vehicles require lamps of a greater mechanical strength.

Within the constraints of dimensional and photometric specifications, the ultimate strength of an incandescent lamp is limited by the properties of the filament material. These restrict the mechanical stress to which a lamp can be subjected.

Higher vibration levels may impair the performance of lamps.

Two tests methods are specified:

a) a wideband random vibration test (WBR);

a) a narrowband random vibration test (NBR).

The WBR test is the preferred one, as simulation of service conditions can be achieved most accurately by the use of WBR equipment. However, studies have indicated that a relationship exists between WBR and NBR vibrations. For the purpose of this standard, both tests are equal for testing motor vehicle lamps to vibration resistance.

Analysis of vibration measurements, taken under transient conditions such as door, boot and bonnet closures, shows compatibility with the significant features of both the WBR and NBR test programmes.

The generally accepted requirements of a fatigue life of 10^7 reversals is encompassed by the schedule in IEC 60068-2-6.

Measurements of vibration and shock characteristics in service reveal frequencies of up to 20 000 Hz.

A vibration level is expressed as acceleration spectral density (ASD). It is the spectral density of an acceleration variable and is given in units of acceleration squared per unit frequency.

ASD spectrum defines the way ASD varies within the frequency range.

The ASD levels at frequencies above 1 000 Hz are, however, so low as to be insignificant, as the resonant frequencies of the critical construction features of most automobile lamps fall within the range of 200 Hz to 800 Hz. This, together with problems in the design of fixtures suitable for operation at frequencies above this level, has led to the adoption of 1 000 Hz as the maximum limit for the test schedules (excluding half bandwidth).

B.2 Test conditions

Figure B.1 details the preferred arrangement of equipment for the testing of lamps of WBR or NBR tests.

In order to be assured of reliable and reproducible test results the following procedures should be followed.

B.2.1 **Mounting** (see IEC 60068-2-47)

The lamp caps shall be fastened rigidly to the work holders on the vibration head. This may be achieved by clamping, soldering or embedding. Electrical connection to the lamps shall be made by the use of soldered wires or other means such that electrical connection is ensured during the whole test.

On tests including higher frequencies, it is essential that fixtures are designed in such a way that the propagation path (the distance between lamp and moving coil) is always shorter than the one-quarter wavelength of the velocity of sound in the fixture material.

B.2.2 Measuring points

A measuring point is the position at which measurements are made to ensure that the test requirements are met. The measuring point shall be on the fixture as close as possible to the position at which the lamp is held and the detector shall be rigidly connected to it.

If several lamps are mounted on a single fixture, the measuring point may be related to the fixture generally rather than the lamp fixing points.

The resonant frequency of the fully loaded fixture shall always be higher than the maximum test frequency.

B.2.3 Control point

The signal from the transducer mounted at the measuring point shall be used as a means of maintaining the specified vibration characteristics.

B.2.4 Conditioning

Filament lamps shall be aged for 30 min at test voltage as given on the relevant data sheets of IEC 60809. No ageing period is required for discharge lamps, but lamps which fail before starting a vibration test shall be omitted from the test results.

B.2.5 Axis of vibration

Field measurements on vehicles have shown that automobile lamps are usually subjected to greater stresses in the vertical plane than in either of the horizontal planes. It is therefore recommended that a vertical direction

of excitation be used for testing with the principal lamp axis and filament(s) horizontal.

B.2.6 WBR test – Basic motion

The basic motion of the control point on the test fixture (see Figure B.1) shall be rectilinear and of a stochastic nature with a normal (Gaussian) distribution of instantaneous acceleration values. Peak values are limited to three times the r.m.s. value as determined by the ASD profile and its frequency range (i.e. "3□-clipping"). Experience has shown that a peak factor set to 2,3 at the exciter corresponds to a 3 □ test signal at the control point because of filtering by the vibrator (see ISO 5344).

B.3 Test conditions

The test voltage for filament lamps shall be in accordance with IEC 60809. For discharge lamps, the conditions of Clause D.2 of this standard apply.

The specific vibration test conditions are given as follows:

Narrowband random vibration test	Standard test conditions	Table B.1
	Heavy-duty test conditions	Table B.2
Wideband random vibration test	Standard test conditions	Table B.3

B.3.1 Narrowband random vibration tests

Table B.1 – Vibration test on motor vehicle lamps – Standard test conditions

Narrowband random vibration test	
1 Frequency range	30 Hz to 1 050 Hz
2 Bandwidth	100 Hz
3 Sweep range	80 Hz to 1 000 Hz
4 Sweep rate	1 octave/min
5 Sweep duration (full cycle)	7,3 min
6 ASD spectrum	0,12 g^2/Hz (= 3,5 g eff.) from 80 Hz to 150 Hz 0,014 g^2/Hz (= 1,2 g eff.) from 150 Hz to 1 000 Hz
7 Tolerance of the acceleration values	±1 dB
8 Test duration	20 h
9 Switching cycle	20 min lit to 10 min unlit
10 Compressor speed	10 dB/s

Table B.2 – Vibration test on motor vehicle lamps – Heavy-duty test conditions

Narrowband random vibration test	
1 Frequency range	30 Hz to 1 050 Hz
2 Bandwidth	100 Hz
3 Sweep range	80 Hz to 1 000 Hz
4 Sweep rate	1 octave/min
5 Sweep duration (full cycle)	7,3 min
6 ASD spectrum	0,36 g^2/Hz (= 6,0 g eff.) from 80 Hz to 150 Hz 0,09 g^2/Hz (= 3,0 g eff.)

	from 150 Hz to 1 000 Hz
7 Tolerance of the acceleration values	±1 dB
8 Test duration	20 h
9 Switching cycle	10 min lit to 10 min unlit
10 Compressor speed	10 dB/s

B.3.2 Wideband random vibration tests

Test requirements are given in Table B.3 for standard service.

Requirements for heavy-duty service are under consideration.

Table B.3 – Vibration test on motor vehicle lamps – Standard test conditions

Wideband random vibration test	
1 Frequency range	12 Hz to 1 002 Hz
2 ASD spectrum	Hz g^2/Hz 12 0,01 12-24 0,01-0,15 24-54 0,15 54-1 002 0,15-0,0082
3 Total r.m.s. acceleration level	5,4 g ± 1 dB[a]
4 Tolerance of the true ASD values	±3 dB[a]
5 Switching cycle	20 min lit to 10 min unlit
6 Test duration	20 h
NOTE 1 The acceleration level increases logarithmically with the logarithm of the frequency in the range 12 Hz to 24 Hz (12 dB/octave) and it decreases in the range 54 Hz to 1 002 Hz (–3 dB/octave). Outside the specified frequency range, the ASD levels has to decrease with gradients as steep as possible. NOTE 2 All data are provisional.	
[a] This represents "reproducibility high" according to IEC 60068-2-64.	

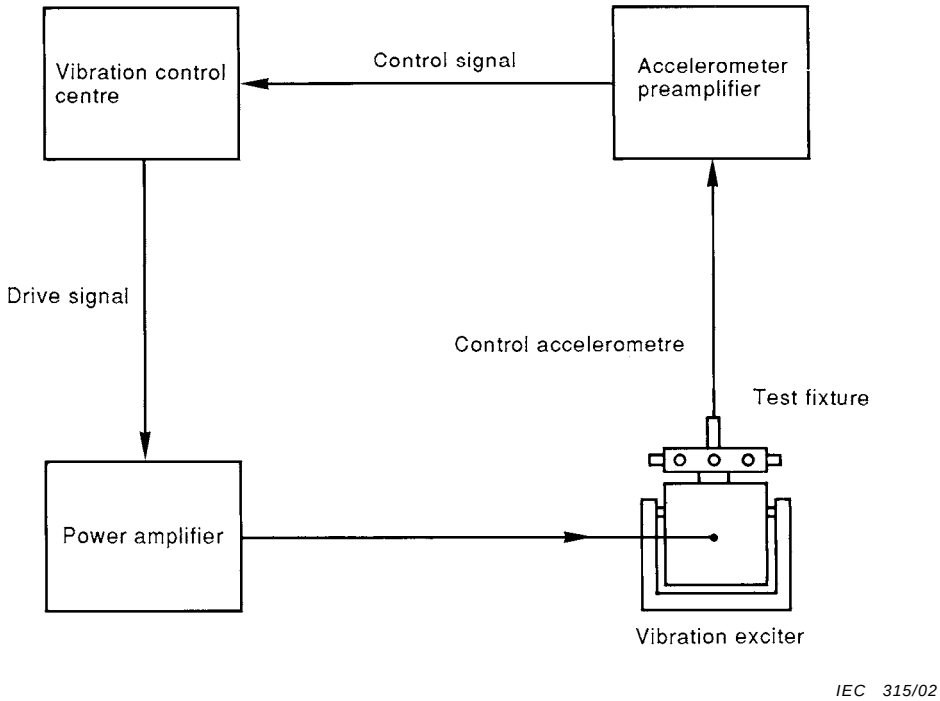


Figure B.1 – Recommended equipment layout for vibration testing

Annex C
(normative)

Glass-bulb strength test

C.1 General

If required, the test specified in this annex shall be used to determine the glass-bulb strength of certain road vehicle filament lamps.

This test is necessary for these filament lamps because mechanical handling is utilized for their assembly in equipment.

C.2 Test equipment and procedure

C.2.1 Principle of the test equipment

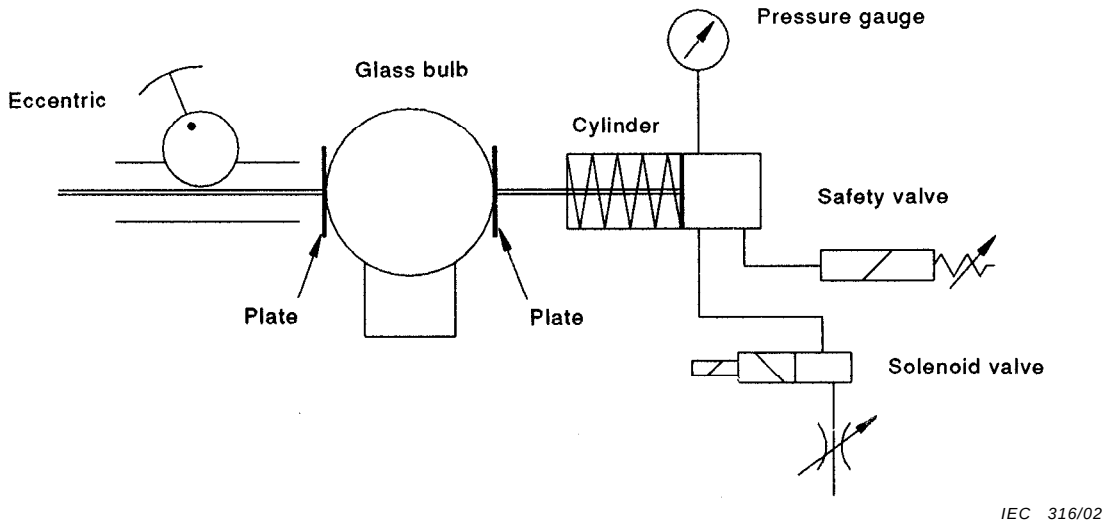


Figure C.1 – Diagrammatic sketch of the principle of the test equipment

The test apparatus consists mainly of

- a pneumatic cylinder applying the necessary force;
- two plates transmitting the force on to the test sample;
- a measuring apparatus indicating the applied force.

C.2.2 Test conditions

This apparatus shall test bulbs with a maximum diameter of 50 mm. The bulb shall be tested with a slowly increasing compressive force. In no case shall bulbs be exposed to a shock load.

The increase of force from 0 N to 200 N shall be in 4 s to 5 s during which period the force increases approximately in a linear manner.

It shall be possible to limit the maximum force of the apparatus to 200 N by a compression safety valve. The apparatus shall incorporate a suitable protective screen to prevent injury from glass fragments in the event of a bulb failure during the test.

C.2.3 Requirements for plates

Each plate shall have a plane smooth surface with a diameter of approximately 20 mm and shall be of hardened tool steel. The hardness of the plates shall lie between 55 Rockwell and 60 Rockwell (HRC).

C.3 Requirements

The compression strength of the bulb shall not fall below the values stated in the following table taking an AQL 1 % as a basis.

Table C.1 – Compression strength

Category	Minimum glass-bulb strength N
R2	40
P21W	40
P21/5W	40
R5W	40
R10W	40
T4W	40
W3W	40
W5W	40

C.4 Evaluation

One of the following procedures shall be applied.

C.4.1 Assessment based on attributes

Set the test apparatus at the minimum force specified in Table C.1. A first sample is selected randomly from the batch, the number selected being determined by the batch size (see Table C.2). The number of bulbs failing are compared with the acceptance and rejection numbers. If there is no decision, a second sample is tested in accordance with Table C.2.

Table C.2 – Inspection by attributes – Double sampling plan

Batch size	Sample	Accept	Reject
1 201 to 3 200	1st sample $n1$ = 80 2nd sample $n2$ = 80	1 4	4 5
3 201 to 10 000	1st sample $n1$ = 125 2nd sample $n2$ = 125	2 6	5 7
10 001 to 35 000	1st sample $n1$ = 200 2nd sample $n2$ = 200	3 8	7 9
35 001 to 150 000	1st sample $n1$ = 315 2nd sample $n2$ = 315	5 12	9 13

NOTE If a second sample has to be taken, the number of filament lamps failing in the combined sample is compared with the acceptance and rejection numbers in the corresponding line.

This random test, based on attributes, corresponds with IEC 60410.

C.4.2 Assessment based on variables

The size of the sample (selected randomly) is determined by the batch size as shown in Table C.3.

Each filament lamp is tested until it fails and the value at which this occurs is recorded.

The result is assessed as follows.

The lower quality statistic (Q_L) is calculated using the equation:

$$Q_L = \frac{\overline{X} - 40}{S}$$

where

$\overline{X}$ is the mean value of all the results in the sample.

$$S = \sqrt{\frac{\sum_{i=1}^{i=n} (X_i - \overline{X})^2}{n-1}}$$

where

X_i is the value of individual results;

n is the number of results.

The test is passed if: $Q_L \geq K$

where

K is the acceptability constant determined from Table C.3.

Table C.3 – Inspection by variables – "S" method of assessment

Batch size	Sample size	Acceptability constant K
1 201 to 3 200	15	1,79
3 201 to 10 000	20	1,82
10 001 to 35 000	25	1,85
35 001 to 150 000	35	1,89
NOTE 1 The statistical basis of this method assumes that the distribution of results is normal, or nearly so.		
NOTE 2 Tests for normality may be made by the use of probability paper plots in accordance with ISO 2854.		
NOTE 3 This test, based on variables, corresponds with ISO 3951.		

Annex D
(normative)

Life and lumen maintenance test conditions for discharge lamps

D.1 Ageing

No ageing period is required, but lamps which fail before starting the life test shall be omitted from the test results.

For lamps subject to the lumen maintenance test, the initial luminous flux shall be measured after 10 switching cycles as prescribed in Clause D.4

D.2 Test circuit and test voltage

Discharge lamps shall be tested with the ballast submitted by the lamp manufacturer and, preferably, designed to operate the lamp in a nominal 12 V system. The test voltage to the ballast shall be 13,5 V. The power supply to the ballast shall be sufficient to secure the high- current flow.

D.3 Burning position and operating conditions

Discharge lamps shall be operated in free air with an ambient temperature of 25 °C ± 5 °C. The burning position shall be horizontal within 10°, with the lead wire down.

NOTE It is necessary to take care to protect service employees against high tensions occurring during starting, run-up and operating, emitted UV radiation and risk of bulb breakage.

D.4 Switching cycle

One switching cycle is built up of the following 10 on-off periods:

Period	On min	Off min
1	20	0,2
2	8	5
3	5	3
4	3	3
5	2	3
6	1	3
7	0,5	3
8	0,3	0,3
9	20	4,7
10	20	15

The total duration of one switching cycle is 120 min, during which the lamp is switched on for 79,8 min and switched off for 40,2 min. The time during which the lamp is switched off is not considered as part of the life.

Life tests may be interrupted for the purpose of the lumen maintenance test.

D.5 Lumen maintenance

The lumen maintenance is measured after the lamp has been operated 75 % of the characteristic life as declared by the manufacturer.

Annex E
(normative)

Bulb deflection test

E.1 General

If required, the test specified in this annex shall be used to determine the strength of the bulb- to-cap connection of discharge lamps.

E.2 Test set-up and procedure

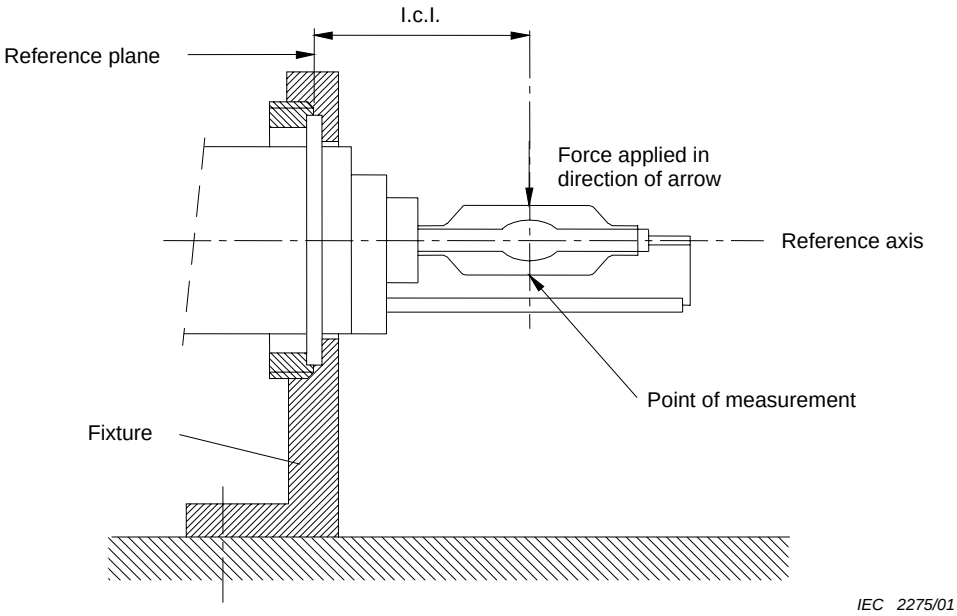


Figure E.1 – Sketch of the test set-up

The lamp shall be rigidly and horizontally mounted in the fixture, with the reference notch in the up position. A force of 18 N is applied on the glass bulb

– at a distance from the reference plane equal to the light centre length of the lamp;

– perpendicular to the reference axis;

– using a rod with a hard rubber tip with a minimum spherical radius of 1 mm;

– four times, spaced 90° apart, starting in the vertical direction.

NOTE The spacing of 90° is approximate, depending on the position of the outer supply wire.

The force shall be gradually increased from 0 N to 18 N.

The bulb deflection shall be measured at the glass surface 180° opposite to the force application.

A different lamp shall be used for each force application at 0°, 90°, 180° and 270°.

E.3 Requirement

The deflection shall not exceed 0,13 mm in the direction of the force applied.

Annex F
(informative)

Guidance for equipment design

F.1 Pinch temperature limit

Headlamps, fog-lamps and signalling lamps should be so designed that in operation the pinch temperature of halogen lamps does not exceed 400 °C.

NOTE 1 Specially prepared filament lamps are required for the pinch temperature test and reference should be made to the filament lamp supplier.

NOTE 2 For pinch temperature measuring method, see IEC 60682.

F.2 Solder temperature limit

Headlamps, fog-lamps and signalling lamps should be so designed that in operation the solder temperature of filament lamps does not exceed the following limits:

– 290 °C for single-filament lamps;

– 270 °C for double-filament lamps.

F.3 Maximum filament lamp outline

Maximum filament lamp outline is provided for the guidance of designers of lighting equipment and is based on a maximum sized filament lamp inclusive of bulb-to-cap eccentricity and tilt. Observance of these requirements in the equipment design will ensure mechanical acceptance of filament lamps complying with IEC 60809. Details are given in Figures F.2 to F.5.

F.4 Maximum surge voltage

Maximum surge voltage values are provided for the guidance of designers of electrical equipment. They are specified as maximum tolerable duration as a function of the height of voltage surge.

This does not imply that values shorter than the specified ones have a negligible effect on filament lamp performance, but only that a higher voltage or duration in any case harm the filament lamp and should be avoided. Values in graphical form are given in Figure F.1.

F.5 Recommended instructions for use and handling of halogen filament lamps

It is recommended that the following points be included in any instructions for use if supplied with halogen filament lamps covered by this standard. Symbols as shown in Annex H (Clause H.2 to H.5) may be used in addition or as an alternative to text information.

– Halogen filament lamps operate at high bulb temperatures and care should be taken to avoid touching the bulb in any circumstances.

– If filament lamps with quartz bulb are touched, they should be cleaned before use with a lint-free cloth moistened with methylated spirit.

– Filament lamps with scratched or otherwise damaged bulbs should not be used.

NOTE In some instances filament lamp manufacturers give information that the filament lamp contains gas under pressure and recommend protective measures when handling it.

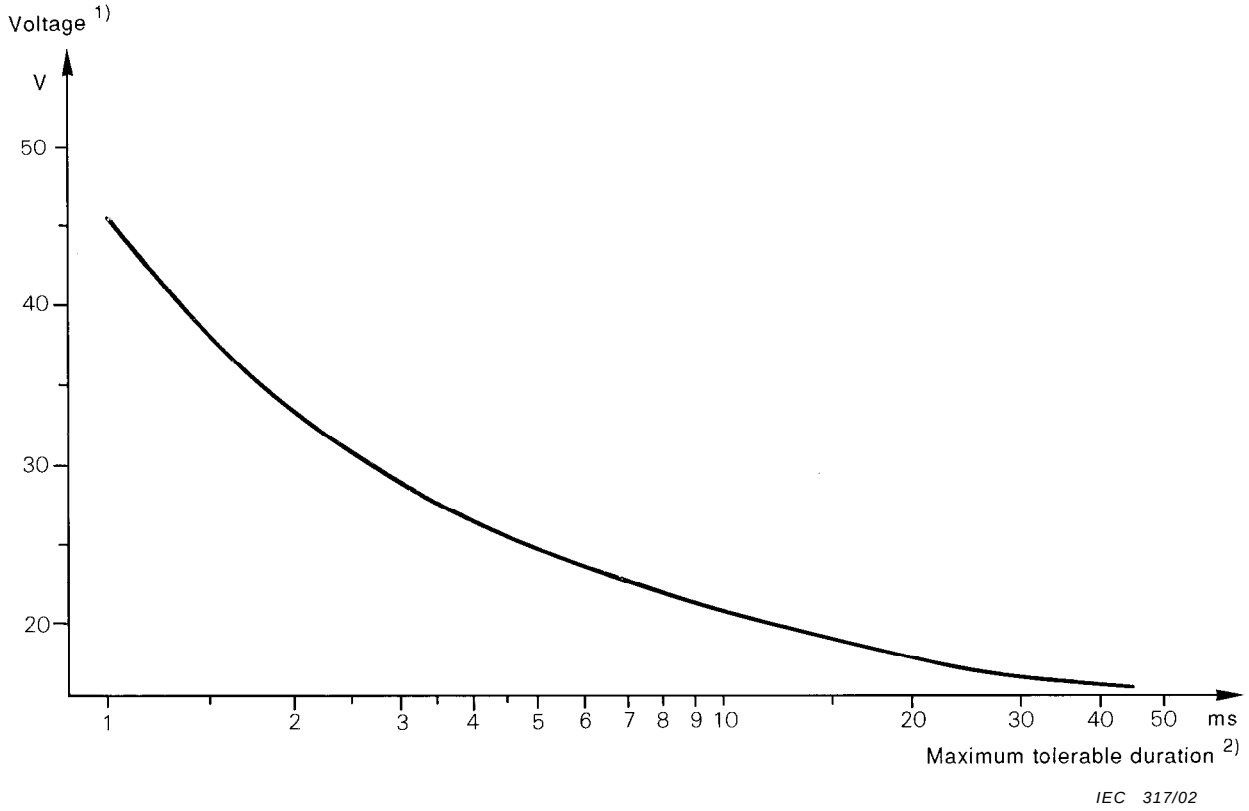
F.6 Recommended instructions for use and handling of discharge lamps

It is recommended that the following points are included in any instructions for use if supplied with discharge lamps covered by this standard. Symbols as shown in Annex H (Clause H.2 to H.10) may be used in addition or as an alternative to text information.

– Care should be taken to avoid touching the bulb in any circumstances. The use of protective gloves and eye protection is advised. If the bulb is touched, it should be cleaned before use with a lint-free cloth moistened with methylated spirit. Lamps with scratched bulbs should not be used.

– Discharge lamps operate with a suitable ballast which produces very high voltage when switching and during operation. During operation, the bulb of the discharge lamp emits UV-radiation. In order to avoid any safety risk or impairment of health, the discharge lamps should only be used in closed headlamps.

– Discharge lamps operate at high temperatures. Before handling, the lamp should be left to cool down for an appropriate time and the supply voltage to the ballast should be disconnected.

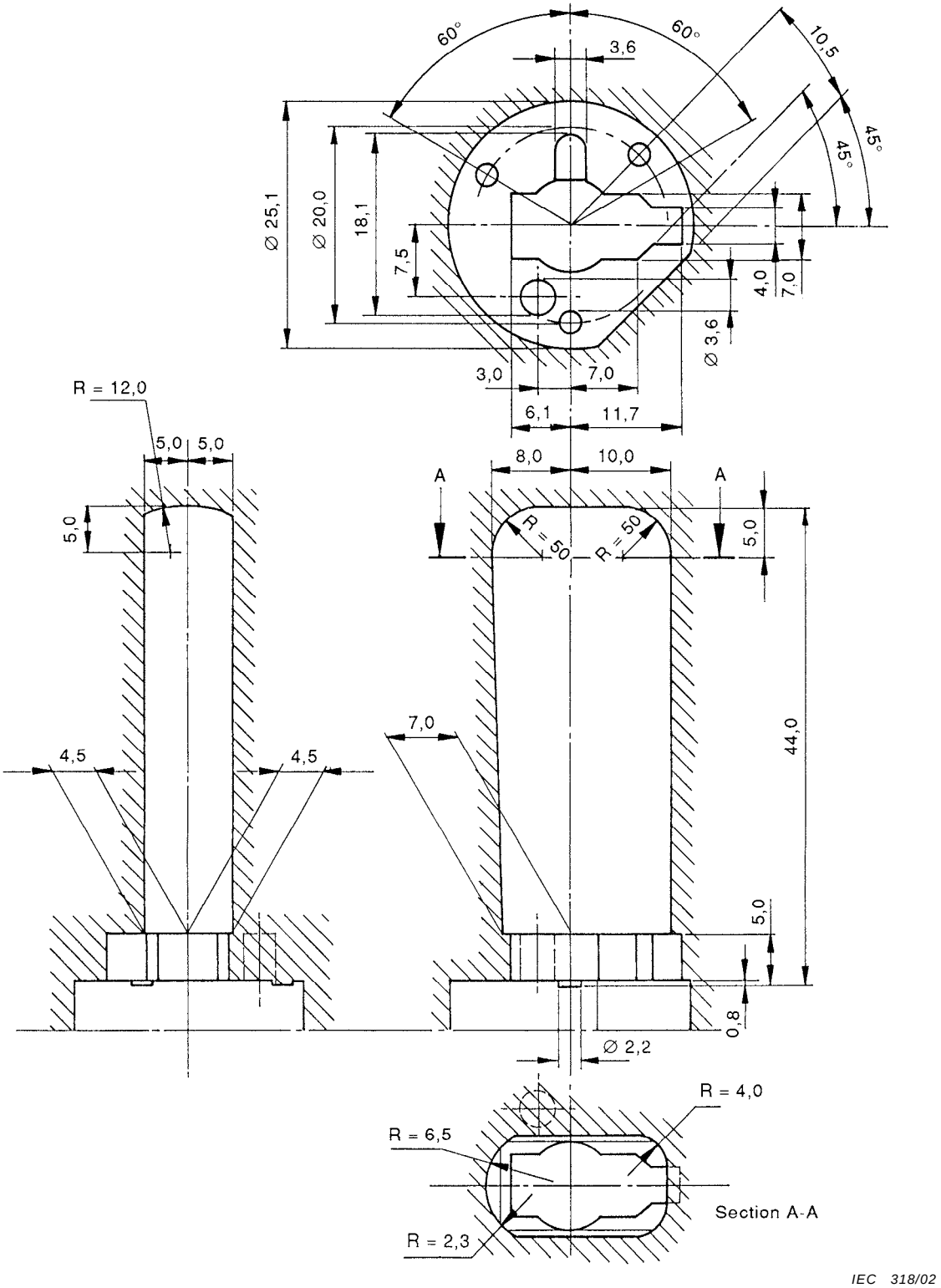


1) Voltage surges are superimposed on a stabilized voltage of 14,5 V after a burning period of at least 30 s. The voltage shown on the graph above is the sum of the stabilized 14,5 V and the voltage surge.

2) If this maximum tolerable duration is exceeded, a certain percentage of filament lamps will fail immediately. The resulting influence on the non-failing filament lamps is being studied.

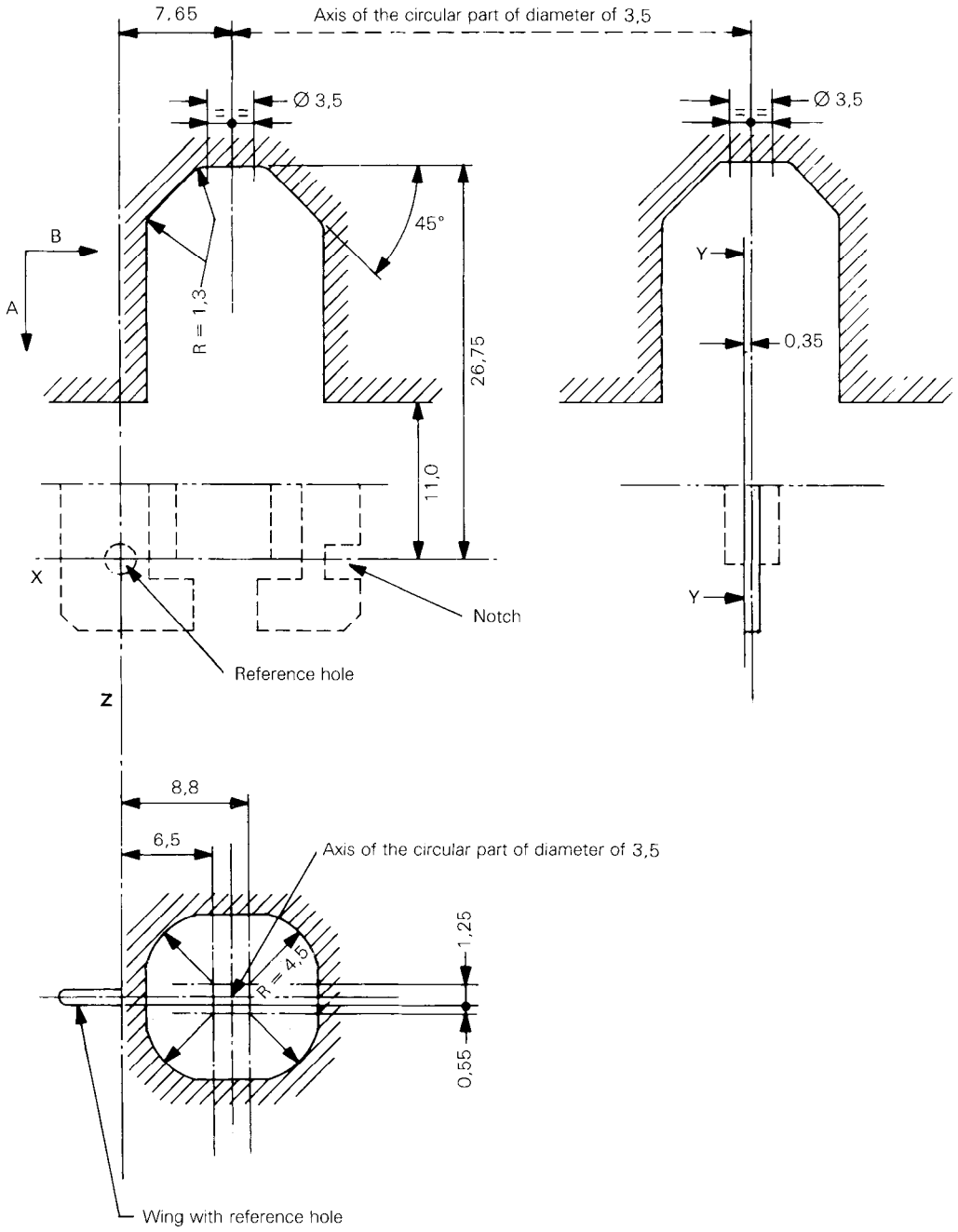
NOTE Data for 24 V filament lamps are under consideration. Further details of the surge are under consideration.

Figure F.1 – Voltage surges for 12 V filament lamps – Maximum tolerable duration for a voltage surge as a function of its height



Dimensions in millimetres

Figure F.2 – Maximum filament lamp outlines H1



IEC 319/02

Dimensions in millimetres

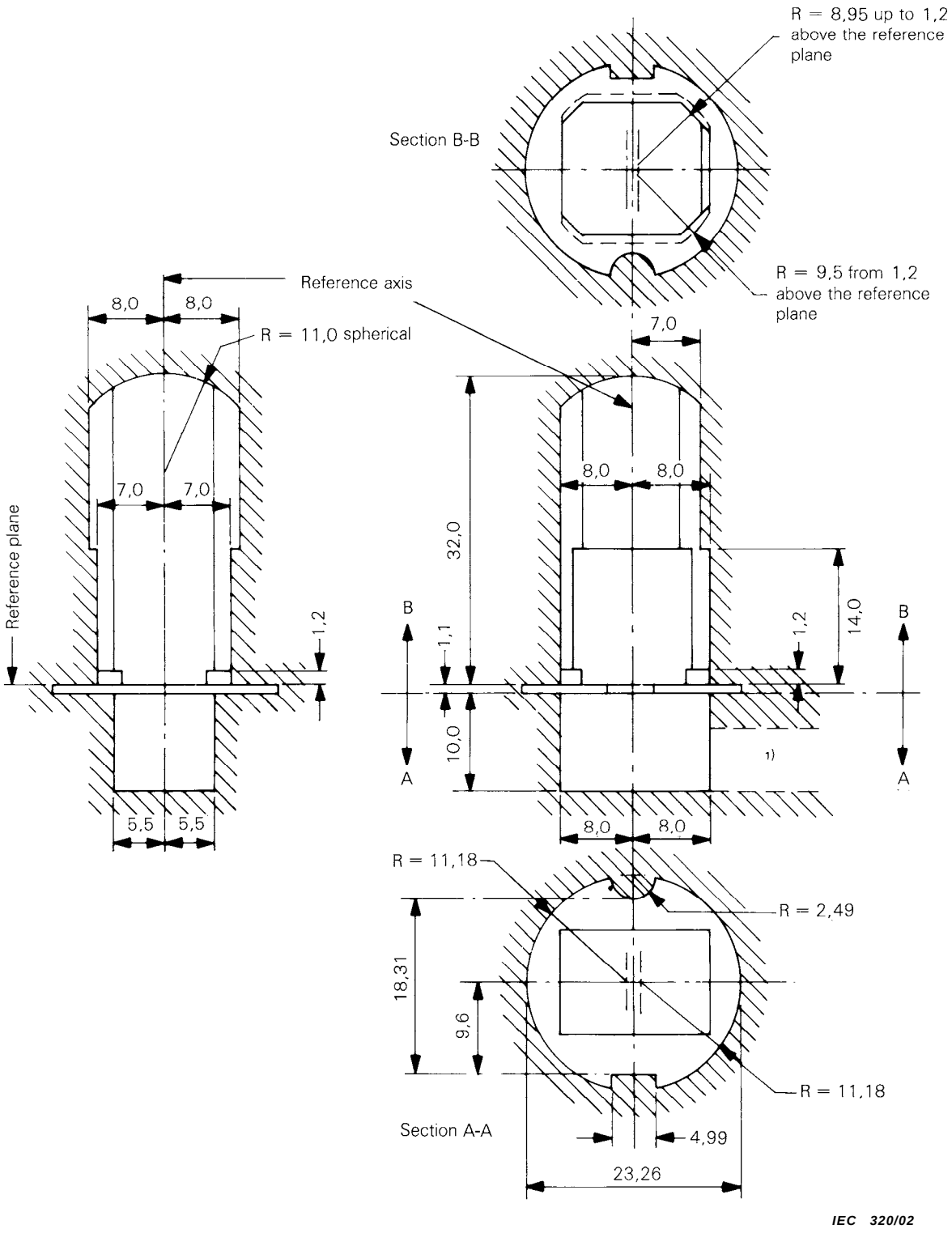
Key

X is the reference axis common to the reference hole and the notch.

Z is the reference plane containing reference axis of the hole and perpendicular to X axis.

Y is the supporting plane of the wings.

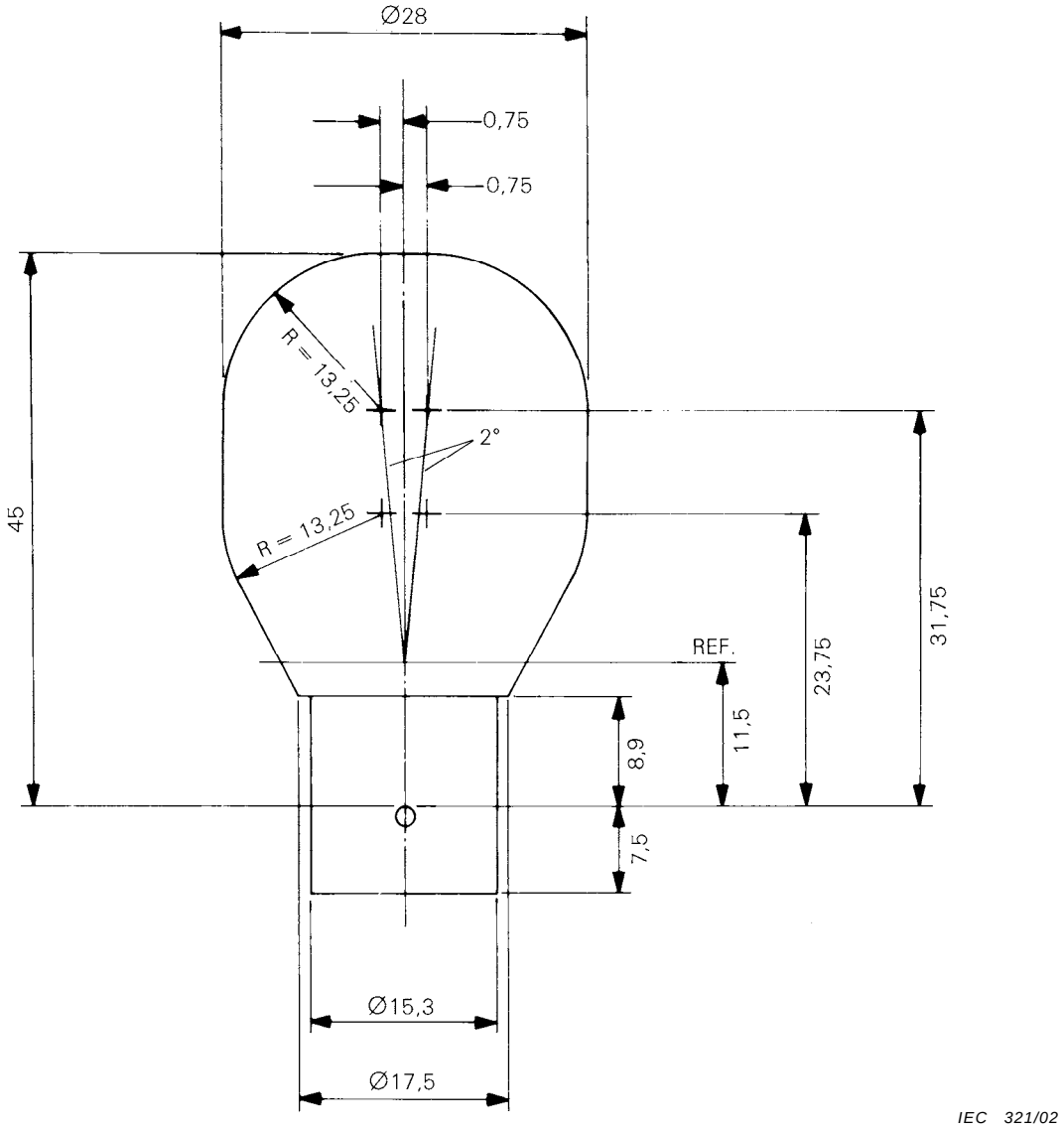
Figure F.3 – Maximum filament lamp outlines H2



Dimensions in millimetres

1) Maximum lamp outline for the passage of the insulated cable and connector tab.

Figure F.4 – Maximum filament lamp outlines H3



Dimensions in millimetres

Figure F.5 – Maximum filament lamp outlines P21W, PY21W, P21/4W and P21/5W

Annex G
(informative)

Information for ballast design

G.1 Discharge lamps with integrated starting device

The integrated starting device may make use of a spark gap to generate the high-voltage starting pulse. The ballast should provide an open-circuit voltage and a voltage to fire the spark gap as follows.

Open- circuit voltage (r.m.s.) [V]	min.	360
	max.	600
Voltage to fire spark gap (peak)[V]	min.	1 000

Annex H
(informative)

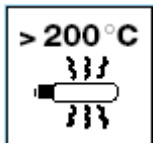
Symbols

H.1 General

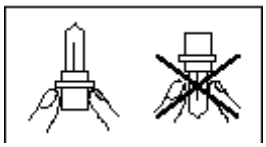
This annex concerns symbols as referred to in Clauses F.5 and F.6.

The height of graphical symbols shall not be less than 5 mm, and for letters, not less than 2 mm.

H.2 Symbol indicating that lamps operate at high temperatures



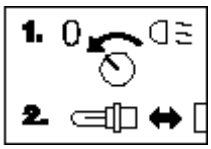
H.3 Symbol indicating that care should be taken to avoid touching the bulb



H.4 Symbol indicating that the use of protective gloves is advised

H.5 Symbol indicating that lamps with scratched or otherwise damaged bulbs should not be used

H.6 Symbol indicating that before handling, the lamp shall be switched off



H.7 Symbol indicating that the use of eye protection is advised

H.8 Symbol indicating that during operation, the lamp emits UV-radiation

H.9 Symbol indicating that the lamp shall be operated only in a luminaire with a protective shield

H.10 Symbol indicating dangerous voltage

Bibliography

IEC 60068-2-64:1993, *Environmental testing – Part 2-64: Test methods – Test Fh: Vibration, broad-band random (digital control) and guidance*

IEC 60682:1980, *Standard method of measuring the pinch temperature of quartz-tungsten-halogen lamps*

ISO 2854:1976, *Statistical interpretation of data – Techniques of estimation and tests relating to means and variances*

ISO 3951:1989, *Sampling procedures and charts for inspection by variables for percent non-conforming*

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