74 LED light sources

Refer to: R128 00-S7

74.1 Effective Date and Scope:

74.1.1 Effective date from 2017/1/1, the new types of LED replaceable light sources and from 2019/1/1 the all types of LED replaceable light sources used in safety type approval lamps of vehicle category M, N, O and L, shall comply with this regulation.

74.1.2 The applicants applying for low volume safety type approval may be exempt from regulation of “LED light sources” except for large passenger vehicle and child-only vehicle.

74.1.3 Applying for vehicle-by-vehicle low volume safety type approval, the vehicle may be exempt from regulation of “LED light sources”.

74.1.4 Technical Service can carry out test according to UN Regulations that this direction harmonized with: UN R128 00 Series of amendments and following amendments of above-mentioned regulations.

74.2 Definitions

74.2.1 General

74.2.1.1"Light source" means one or more elements for visible radiation, with a base for mechanical and electrical connection, possibly assembled with one or more components to control the elements for visible radiation;

74.2.1.1.1 "Filament light source" means a light source where the only element for visible radiation is one or more filaments producing thermal radiation;

74.2.1.1.2 "Gas-discharge light source" means it conforms to category of 74.2.5.1 Specifications marked and a light source where the only element for visible radiation is a discharge arc producing electroluminescence;

74.2.1.1.3 "Light-emitting diode (LED) light source" means it conforms to category of 74.2.5 Specifications marked and a light source where the only element for visible radiation is one or more solid state junctions producing electroluminescence possibly completed with one or more elements for fluorescence-based conversion.

74.2.1.2"Standard (étalon) light source" means a special light source used for the testing of lighting and light-signalling devices. It has reduced tolerances for dimensional, electrical and photometric characteristics as specified on the relevant data sheet.

74.2.1.3"Ballast" means one or more components, either between supply and light source or integrated with a light source, to control the electrical current of the gas-discharge light source;

74.2.1.4"Objective value(s)" means design value(s) to be achieved within specified tolerances when the light source or the ballast of the gas discharge light source is energized at specified test voltage(s)

74.2.2 Dimensional characteristics

74.2.2.1"Reference axis" means an axis defined with reference to the cap and to which certain dimensions of the light source are referred.

74.2.2.2"Reference plane" means a plane defined with reference to the cap and to which certain dimensions of the light source are referred.

74.2.2.3"Light centre" means a point that represents the origin of the light emitted.

74.2.2.4"Light centre length" means the distance between the reference plane and the light centre.

74.2.2.5"Viewing axis on to the light source" means an axis through the nominal light centre at defined polar and azimuthal angle.

74.2.3 Electrical characteristics

74.2.3.1"Test voltage" means the voltage, at the input terminals of the light source or at the terminals of the ballast for the gas-discharge light source, for which the electrical and photometric characteristics of the light source are intended and are to be tested.

74.2.3.2"Rated voltage" means the voltage (in volts) marked on the light source or on the ballast.

74.2.3.3"Rated wattage" means the wattage marked on the light source or on the ballast.

74.2.4 Photometric characteristics

74.2.4.1"Reference luminous flux" means an accurately specified luminous flux value of a standard light source serving as a reference for the optical characteristics of a lighting or light signalling device.

74.2.4.2"Measuring luminous flux" means specified value of the luminous flux for testing a filament light source with an internal shield to produce the cut-off.

74.2.4.3"Cumulative luminous flux" means the luminous flux emitted by the light source under operating conditions, within a cone enclosing a specified solid angle and centred on the reference axis.

74.2.4.4"Normalized luminous intensity" means luminous intensity divided by the luminous flux of the light source.

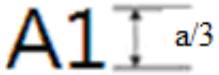
74.2.5 Specifications marked

74.2.5.1 Means the marks shall be clearly legible on the outside of the marking material and shall be indelible to include below:

74.2.5.1.1 Brand (or marking).

74.2.5.1.2 The rated voltage.

74.2.5.1.3 The designation of the relevant category (figure as below , “a” is at least 2.5 mm).



74.3 The principles of applicable type and scope of LED light sources shall be as below:

74.3.1 The same brand. LED light sources bearing the same brand but produced by different manufacturers are considered as being of different types.

74.3.2 The same light source design, in so far as these differences affect the optical results.

74.3.3 The same rated voltage.

74.4 Technical requirements

74.4.1 Visual appearance

74.4.1.1 The replaceable LED light sources of using lamp in Direction shall comply with this regulation.

74.4.1.2 LED light sources 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.

74.4.1.3 LED light sources shall exhibit no scores or spots on their optical surfaces which might impair their efficiency and their optical performance. This shall be verified when commencing approval testing and when required in the respective paragraphs in this Regulation.

74.4.1.4 LED cap of light sources shall conform to the characteristics given in IEC Publication 60061 and apply to LED types of light source.

74.4.1.5 The cap shall be strong and firmly secured to the rest of the LED light source holder.

74.4.1.6 To ascertain whether LED light sources conform to the requirements of paragraphs 74.4.1.3 to 74.4.1.5 above, a visual inspection, a dimension check and, where necessary, a trial fitting into the holder as specified in IEC publication 60061 shall be carried out.

74.4.1.7 The solid state junction(s) and possibly one or more elements for fluorescence-based conversion shall be the only element(s)

of the LED light source that generate(s) and emit(s) light when energized.

74.4.2 Tests

74.4.2.1 LED light sources shall first be aged at their test voltage for at least forty-eight hours. For multi-function LED light sources, each function shall be aged separately.

74.4.2.2 Unless otherwise specified, electrical and photometric measurements shall be carried out at the relevant test voltage(s).

74.4.2.3 Electrical measurements as specified in paragraphs 74.5 shall be carried out with instruments of at least class 0.2 (0.2 per cent full scale accuracy).

74.4.3 Position and dimensions of apparent light emitting area

74.4.3.1 The position and dimensions of the apparent light emitting area shall conform to the requirements as given on the relevant data sheet.

74.4.3.2 The measurement shall be made after ageing the LED light source according to paragraph 74.4.2.1.

74.4.4 Luminous flux

74.4.4.1 When measured according to the conditions specified in paragraphs 74.5, the luminous flux shall be within the limits given on the relevant data sheet.

74.4.4.2 The measurement shall be made after ageing the LED light source according to 74.4.2.1.

74.4.5 Normalized luminous intensity distribution / cumulative luminous flux distribution

74.4.5.1 When measured according to the test conditions specified in paragraphs 74.5 , the normalized luminous intensity distribution and/or cumulative luminous flux distribution shall be within the limits given on the relevant data sheet.

74.4.5.2 The measurement shall be made after ageing the LED light source according to paragraph 74.4.2.1.

74.4.6 Colour

74.4.6.1 The colour of the light emitted by the LED light sources shall be specified on the relevant data sheet. The definitions of the colour of the light emitted, given in “The installation of lighting and light-signalling devices” and its series of amendments in force at the time of application for type approval shall apply to this Regulation.

74.4.6.2 The colour of the light emitted shall be measured by the method specified in 74.5. The measured integral value of the chromaticity coordinates shall lie within the required chromaticity area.

74.4.6.2.1 Moreover, in the case of LED light sources emitting white light and for use in forward lighting devices, the colour shall

be measured in the same directions as where the luminous intensity distribution is specified in the relevant data sheet, but only where the specified minimum luminous intensity is exceeding 50 cd/klm. Each measured value of the chromaticity coordinates shall lie within a tolerance area of 0.025 units in the x direction and 0.050 units in the y direction, containing the measured integral value. The measured value in the direction of maximum luminous intensity and all measured values for a standard (etalon) LED light source shall also lie within the required chromaticity area for white light.

74.4.6.3 Moreover, in the case of LED light sources emitting white light, the minimum red content of the light shall be such that:

$$k_{red} = \frac{\int_{\lambda=610nm}^{780nm} E_e(\lambda)V(\lambda)d\lambda}{\int_{\lambda=380nm}^{780nm} E_e(\lambda)V(\lambda)d\lambda} \geq 0.05$$

where:

Ee(lambda) (unit: W) is the spectral distribution of the irradiance;

V(lambda) (unit: 1) is the spectral luminous efficiency;

lambda (unit: nm) is the wavelength.

This value shall be calculated using intervals of one nanometer.

74.4.7 UV-radiation

The UV-radiation of the LED light source shall be such that the LED light source is of the low UV type complying with:

$$k_{UV} = \frac{\int_{\lambda=250nm}^{400nm} E_e(\lambda)S(\lambda)d\lambda}{k_m \int_{\lambda=380nm}^{780nm} E_e(\lambda)V(\lambda)d\lambda} \leq 10^{-5} W/lm$$

where:

S(lambda)(unit: 1) is the spectral weighting function;

km = 683 lm/W is the maximum value of the luminous efficacy of radiation.

This value shall be calculated using intervals of one nanometer.

The UV-radiation shall be weighted according to the S(lambda) values as indicated in the Table below:

lambda	S(lambda)	lambda	S(lambda)
250	0.430	330	0.00041
255	0.520	335	0.00034
260	0.650	340	0.00028
265	0.810	345	0.00024
270	1.000	350	0.00020
275	0.960	355	0.00016
280	0.880	360	0.00013
285	0.770	365	0.00011
290	0.640	370	0.000090
295	0.540	375	0.000077
300	0.300	380	0.000064
305	0.060	385	0.000053
310	0.015	390	0.000044
315	0.003	395	0.000036
320	0.001	400	0.000030
325	0.00050		

74.4.8 Standard LED light sources: Standard LED light sources shall comply with corresponding relevant data sheets of light source type.

74.4.9 Maximum test temperature

In case a maximum test temperature is specified in the relevant data sheet, the following requirements shall apply:

74.4.9.1 When measured according to the conditions specified in paragraph 74.5.5:

(a) The luminous flux values at elevated temperatures shall be within the limits given in the relevant data sheet of Annex 1; and

(b) The colour variation shall not exceed 0.010.

74.4.9.2 After completion of the measurement procedure as prescribed in paragraph 74.4.9.1, the LED light source shall be

continuously operated during 1000 h at the relevant test voltage(s); and

(a) In case of an integrated heatsink at an ambient temperature corresponding to the maximum test temperature as specified in the relevant data sheet;

(b) In case of a specified Tb-point at a Tb-value corresponding to the maximum test temperature as specified in the relevant data sheet.

74.4.9.3 After completion of the procedure as prescribed in paragraph 74.4.9.2, when measured according to the conditions specified in paragraph 74.5.5:

(a) The luminous flux values at elevated temperatures shall not deviate by more than +/- 10 per cent from the corresponding values of the individual sample measured according to paragraph 74.4.9.1; and

(b) The colour variation shall not deviate from the corresponding values of the individual sample measured according to paragraph 74.4.9.1 by more than +/- 0.010.

74.4.9.4 After completion of the measurement procedure as prescribed by paragraph 74.4.9.3, the requirements in 74.4.1.3 shall be verified again.

74.4.10 LED light sources without general restrictions

74.4.10.1 Light emitting area characteristics

The size and position of the nominal emitter box as well as the side(s) of the light emitting area capable to generate the cut-off are specified in the relevant data sheet.

The values of the following characteristics shall be determined by using the method described in paragraph 74.7:

(a) Luminance contrast;

(b) Size and position of zone 1a and zone 1b;

(c) Surface ratio $R_{0.1}$ and $R_{0.7}$

(d) Value of maximum deviation delta L.

74.4.10.2 Luminance contrast of the light emitting area

74.4.10.2.1 The value(s) of luminance contrast of the light emitting area shall be within the limits given on the relevant data sheet.

74.4.10.2.2 In case in the relevant data sheet only one side of the light emitting area is specified as to generate the cut-off, zone 1b shall have a position closer to the corresponding side of zone 1a than to the opposite side.

74.4.10.3 Luminance uniformity of the light emitting area

74.4.10.3.1 The area of zone 1a (light emitting area) shall be within the nominal emitter box as specified in the relevant data sheet, and the size of the light emitting area shall be within the limits given on the relevant data sheet.

74.4.10.3.2 The value of $R_{0.1}$ shall be within the limits given on the relevant data sheet.

74.4.10.3.3 The value of $R_{0.7}$ shall be within the limits given on the relevant data sheet.

74.4.10.3.4 The deviation of the luminance delta L shall not exceed +/- 20 per cent.

74.5 Method of measurement of electrical and photometrical characteristics

LED light sources of all categories with integrated heatsink shall be measured at ambient temperature of (23 +/-2) deg. C in still air. For these measurements the minimum free air space as defined in the data sheets shall be maintained.

LED light sources of all categories with definition of a temperature Tb shall be measured by stabilising the Tb point at the specific temperature defined on the category data sheet.

In case a maximum test temperature is specified in the relevant data sheet additional measurements shall be carried out at elevated temperatures according to the method described in paragraph 74.5.5.

74.5.1 Luminous flux

74.5.1.1 A luminous flux measurement using an integrating method shall be made

(a) In case of an integrated heatsink after 1 minute and after 30 minutes of operation or

(b) After stabilisation of the temperature at the Tb point.

74.5.1.2 The luminous flux values, as measured after

(a) 30 minutes, or

(b) Stabilisation of temperature Tb

74.5.1.2.1 Shall comply with the minimum and maximum requirements.

74.5.1.2.2 In case of (a), unless otherwise specified on the data sheet, this value shall be in between 100 per cent and 80 per cent of the value measured after 1 minute.

74.5.1.3 Measurements have to be carried out at relevant test voltage and at the minimum and maximum values of the relevant voltage range. Unless specified more tightly on the data sheet the following deviation of the luminous flux at the tolerance interval limits shall not be exceeded.

Rated voltage	Min voltage	Max voltage
6	6.0	7.0
12	12.0	14.0
24	24.0	28.0
Corresponding luminous flux tolerance*	+/-30%	+/-15%

*: The maximum luminous flux deviation at the tolerance limits is calculated by using the measured flux at test voltage as reference. In between test voltage and voltage range limits the luminous flux behaviour shall be substantially uniform.

74.5.2 Normalized luminous intensity/ cumulative luminous flux

74.5.2.1 In Measuring below

(a) In case of an integrated heatsink after 30 minutes of operation; or

(b) In case of a Tb point, specified in the relevant data sheet, after stabilisation of the temperature at this Tb point.

74.5.2.2 Measurements have to be carried out at relevant test voltage.

74.5.2.3 Normalized luminous intensity of a test sample is calculated by dividing the luminous intensity distribution as measured under paragraph 74.5.2.1 and 74.5.2.2 by the luminous flux as determined under paragraph 74.5.1.2.

74.5.2.4 Cumulative luminous flux of a test sample is calculated according to CIE publication 84-1989, section 4.3 by integrating the luminous intensity values as measured under 74.5.2.1 and 74.5.2.2 within a cone enclosing a solid angle.

74.5.3 Colour

The colour of the light emitted as measured under the same conditions as described paragraph in 74.5.1.1. shall both be within the required colour boundaries.

74.5.4 Power consumption

74.5.4.1 A power consumption measurement shall be made under the same conditions as described in paragraph 74.5.1.1 using the requirements of paragraph 74.4.2.3.

74.5.4.2 Power consumption measurements shall be carried out at relevant test voltage.

74.5.4.3 Values obtained shall comply with the minimum and maximum requirements of the relevant data sheet.

74.5.5 Photometric measurements in case a maximum test temperature is specified

74.5.5.1 Temperature and temperature range

74.5.5.1.1 Photometric measurements as specified in paragraphs 74.5.5.3, 74.5.5.4 and 74.5.5.5 shall be carried out at elevated temperatures T in steps not larger than 25 deg. C, while the LED light source is continuously operated.

74.5.5.1.1.1 In case of LED light sources of a category with integrated heatsink the temperature range is defined by the ambient temperature of (23 +/- 2) deg. C elevated up to and including the maximum test temperature as specified in the relevant data sheet of Annex1, whereas the minimum free air space as defined in the relevant data sheet shall be maintained and a period of 30 minutes of operation shall be awaited after each increase of the ambient temperature.

74.5.5.1.1.2 In case of LED light sources of a category, for which a temperature Tb is specified, the temperature range is defined by the temperature Tb specified in the relevant data sheet elevated up to and including the maximum test temperature as specified in the relevant data sheet, whereas the temperature at the Tb-point is stabilised before each measurement.

74.5.5.2 Voltage

Measurements shall be carried out at relevant test voltage.

74.5.5.3 Measurement direction of luminous intensity and colour coordinates

All the values of luminous intensity and the colour coordinates in the temperature range as specified by paragraph 74.5.5.1 may be measured in one and the same direction. This direction shall be such that the luminous intensity is exceeding 20 cd for all measurements.

74.5.5.4 Luminous flux values at elevated temperatures

The values of the luminous flux at elevated temperatures T in the range as specified by paragraph 74.5.5.1 may be calculated by correcting the value of the luminous flux as measured according to paragraph 74.5.1.2 of this annex, by the ratio of the luminous intensity values as described in paragraph 74.5.5.3 and the luminous intensity value measured at:

(a) 23 deg. C, in case of an integrated heatsink;

(b) Tb, in case a temperature Tb is defined.

74.5.5.5 Colour variation

The colour variation is the maximum deviation of all colour points (given by the chromaticity coordinates x, y) at elevated temperatures T in the range as specified by paragraph 74.5.5.1, from the colour point (x_0, y_0) at:

(a) 23 deg. C, in case of an integrated heatsink:

$$\max\{\sqrt{[(x(T)-x_0(23^\circ C))^2 + (y(T)-y_0(23^\circ C))^2]}\};$$

(b) Tb, in case a temperature value Tb is defined:

$$\max\{\sqrt{[(x(T)-x_0(T_b))^2 + (y(T)-y_0(T_b))^2]}\}.$$

74.6 Applicants apply for certification test shall provide at least 5 testing object and submit the documents as below:

74.6.1 Testing object specification documents, drawings and / or photographs described in paragraph 74.3.

74.6.2 Drawings sufficiently detailed to permit identification of the type.

74.6.3 Brief technical description

74.6.3.1 The type of LED light sources, rated voltage and colour(s) of the light emitted.

74.6.4 In the case of a type of LED light sources differing only by the trade name or mark from a type that has already been approved it shall be sufficient to submit

74.6.4.1 A declaration by the manufacturer that the type submitted

(a) Is identical with (except in the trade name or mark), and

(b) Has been produced by the same manufacturer as the type already approved, the latter being identified by its approval code.

74.7 Method for the measurement of luminance contrast and luminance uniformity of the light emitting area

74.7.1 The luminance measurement equipment shall be capable to distinguish clearly whether the luminance contrast of the light emitting area is above or below the required level for the LED light source under test.

Further, this equipment shall have a resolution of 20 micrometres or smaller in an area that is larger than the light emitting area of the LED light source under test. In case this equipment has a resolution of less than 10 micrometres, adjacent luminance measurement values shall be arithmetically averaged so as to represent a luminance value of an area of between 10 micrometres and 20 micrometres.

74.7.2 The luminance measurements of an area shall be done in an equidistant grid in both directions.

74.7.3 Zone 1a and zone 1b shall be determined from luminance measurements of an area which consists of the nominal emitter box as specified in the relevant data sheet of Annex 1 and enlarged to all sides by 10 per cent of the corresponding box dimension (see figure 1). The value L_{98} is the 98th percentile of all values of these luminance measurements.

74.7.3.1 Zone 1a (light emitting area) shall be the smallest circumferential rectangle having the same orientation as the nominal emitter

box and containing all luminance measurements with a value of 10 per cent or more of the value L_{98}. The value L_1 shall be the arithmetic average of the values of all luminance measurements in zone 1a (see figure 2).

The value of $R_{0.1}$ shall be the surface ratio of zone 1a where the luminance value is exceeding 10 per cent of the value L_1. The value of $R_{0.7}$ shall be the surface ratio of zone 1a where the luminance value is exceeding 70 per cent of the value L_1.

74.7.3.2 Zone 1b shall be the smallest circumferential rectangle having the same orientation as the nominal emitter box and containing all luminance measurements with a value of 70 per cent or more of the value L_{98}.

74.7.4 Zone 2 shall have in both directions 1.5 times the size of the nominal emitter box as specified in the relevant data sheet of Annex 1 and it shall be positioned symmetrically to the nominal emitter box at a distance of d_0=0.2 mm to zone 1a, unless otherwise specified on the data sheet (see figure 3). The value L_2 shall be the arithmetic average of 1 per cent of all measured luminance values in zone 2 which represent the highest values.

In case in the relevant data sheet more than one side of zone 1a (light emitting area) is specified as to generate the cut-off, for each of these sides a value L_2 shall be determined as described above.

74.7.5 The luminance contrast value(s) shall be the ratio of the luminance value L_1 of zone 1a and the luminance value L_2 of zone(s) 2.

74.7.6 In case the nominal emitter box as specified in the relevant data sheet of Annex 1 is subdivided in n areas (e.g. n = 1 x 4), the same subdivision shall also apply to zone 1a.

74.7.6.1 For each of the n areas the value $L_{1,i}$ (i = 1, ..., n) shall be the arithmetic average of the values of all luminance measurements in the corresponding area.

74.7.6.2 The value delta L shall be the maximum relative deviation of all luminance values $L_{1,i}$ from the luminance value L_1.

delta L = Max { $(L_{1,i} - L_1)/L_{1;\,i}$ = 1, ..., n}

Figure 1: Enlargement of the nominal emitter box

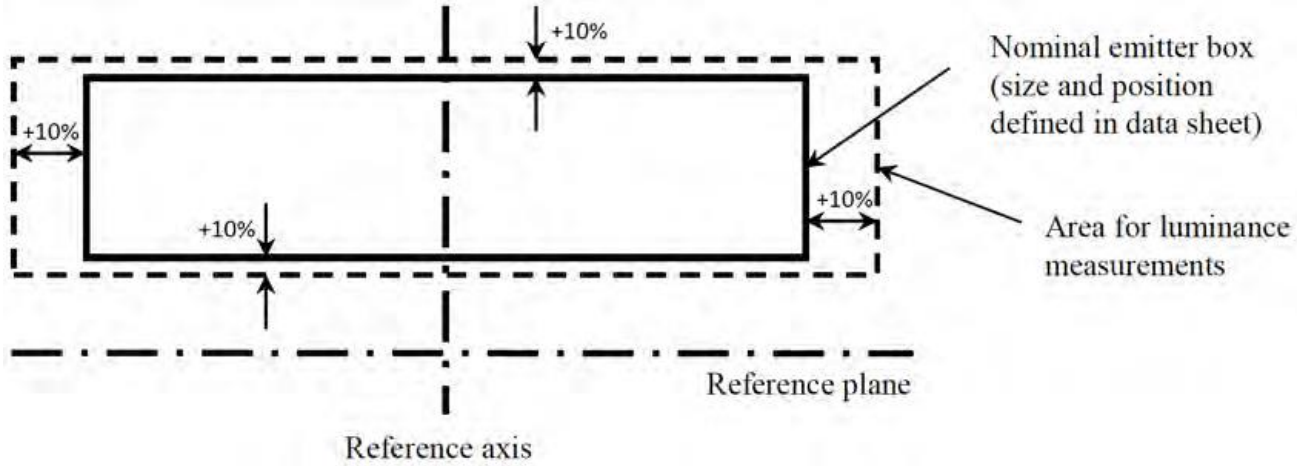


Figure 2: Definition of zones 1a and 1b

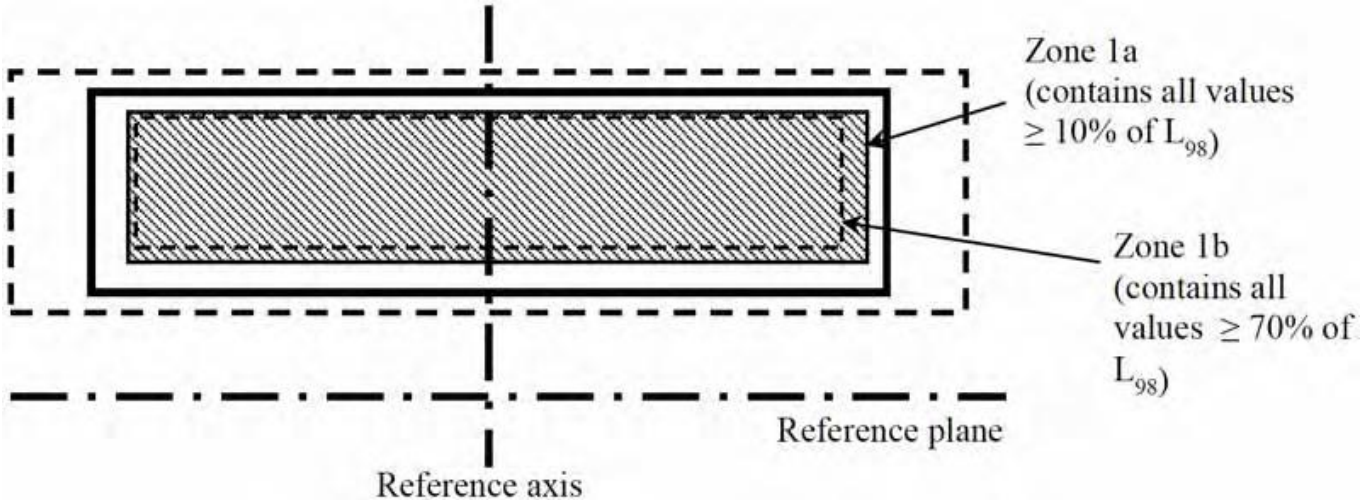
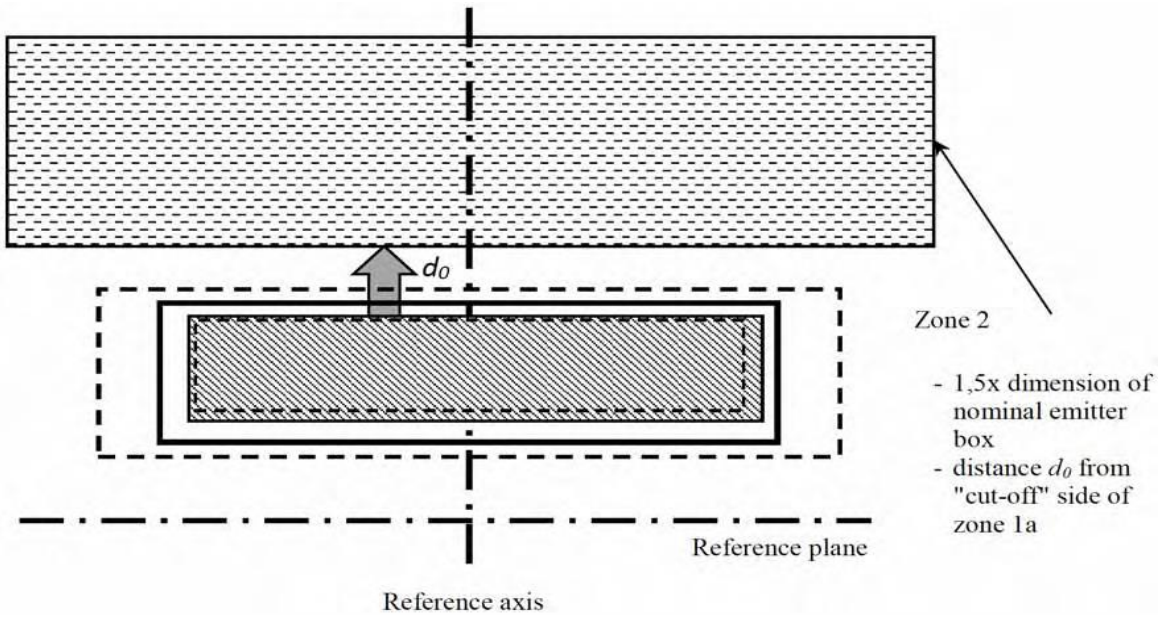


Figure 3: Definition of zone 2


d_0
Zone 2
- 1,5x dimension of nominal emitter box
- distance d_0 from "cut-off" side of zone 1a
Reference plane
Reference axis