Amendment No. 1 19 August 2015
To
AIS-130

Provisions concerning the approval of Light Emitting Diode (LED) light sources for use in approved lamp units on power-driven vehicles and their trailers

1. **Page No. 1/32, Clause No. 1 , Scope**
   Substitute following text for existing text:

   "This standard applies to LED light sources shown in Annex A and intended for use in lighting and light signaling devices as specified in the respective device standard of power-driven vehicles and of their trailers."

2. **Page No. 2/32, Clause No. 2.3.3, 1st line**

   Delete the words and figures "….and 2.4.4…."

3. **Page No. 5/32, Clause 3.8, Table, Row 1, column 5**

   Substitute symbol "λ" for symbol "Λ"

4. **Page No. 14/32, Annex A, Category LR1, Table 3, Row 10, column 2**

   Substitute figure "90" for figure "80"

5. **Page No. 15/32, Annex A, Category LW2, Table 1, Foot note 7**

   Substitute the words and figures " …. - 40° < α < + 40° and - 40° < β < + 40°….." for words and figures "….. 40° < α < + 40° and 40° < β < + 40°…..".

6. **Page No. 28/32, Annex E, Clause E.2, Line 2**

   Delete the word "Regulation"

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THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA
P. B. NO. 832, PUNE 411 004
ON BEHALF OF

AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE
UNDER

CENTRAL MOTOR VEHICLES RULES - TECHNICAL STANDING COMMITTEE
SET-UP BY

MINISTRY OF ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
GOVERNMENT OF INDIA

19 August 2015

AIS-130

AUTOMOTIVE INDUSTRY STANDARD

Provisions concerning the approval of Light Emitting Diode (LED) light sources for use in approved lamp units on power-driven vehicles and their trailers

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July 2015

Status chart of the standard to be used by the purchaser for updating the record

Sr. No.	Corrigenda	Amendment	Revision	Date	Remark	Misc.
General Remarks:						

INTRODUCTION

0.0 The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work on the preparation of the standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the standard and commissioning of test facilities. To this end, the erstwhile Ministry of Surface Transport (MOST) has constituted a permanent Automotive Industry Standards Committee (AISC) vide order No. RT-11028/11/97-MVL dated September 15, 1997. The standards prepared by AISC will be approved by the permanent CMVR Technical Standing Committee (CMVR-TSC). After approval, the Automotive Research Association of India, (ARAI), Pune, being the Secretariat of the AIS Committee, will publish this standard. For better dissemination of this information ARAI may publish this document on their Web site.

0.1 This standard is intended to provide an additional light source option of replaceable approved LED light sources and specifies both dimensional and performance requirements for replaceable LED light sources in the same way that of AIS-034 (Part 1) (Rev 1):2010 for filament light sources and AIS-034 (Part 2) (Rev 1):2010 for gas discharge light sources.

0.2 As the first categories, a dual function replaceable LED light source LR1 and LW2 are proposed. UNECE is working on the specifications of more categories and the same will be considered once covered in UN R 128.

0.3 While preparing this standard, considerable assistance has been taken from following:

UN R 128 (Supplement 1 to the original version of the Regulation – Date of entry into force: 3 November 2013) Uniform provisions concerning the approval of light emitting diode (LED) light sources for use in approved lamp units on power-driven vehicles and their trailers

0.4 The applicability of AIS-037 is deemed mandatory from the date of adoption of this standard in CMVR-TSC.

0.5 The AISC panel responsible for formulation of this standard is given in Annex H

The Automotive Industry Standards Committee (AISC) responsible for approval of this standard is given in Annex I

Provisions concerning the approval of Light Emitting Diode (LED) light sources for use in approved lamp units on power-driven vehicles and their trailers

Provisions concerning the approval of Light Emitting Diode (LED) light sources for use in approved lamp units on power-driven vehicles and their trailers

1. SCOPE

This standard applies to LED light sources shown in Annex A and intended for use in approved signalling 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 Standard to describe different basic design of standardized LED light sources. Each category has a specific designation as for example: "LW1", "LY2", and "LR2"

2.1.2. Definition of "**type**"

LED light sources of different "**types**" are LED light sources within the same category which differ in such essential respects as:

2.1.2.1. Trade name or mark;

LED light sources bearing the same trade name or mark but produced by different manufacturers are considered as being of different types. LED light sources produced by the same manufacturer differing only by the trade name or mark shall be considered to be of the same type.

2.1.2.2. Light source design, in so far as these differences affect the optical results;

2.1.2.3. Rated voltage.

2.2. Application for approval

2.2.1. Application for approval shall be submitted by the applicant. Information to be submitted at the time of applying for type approval of the LED light source shall be given in Annex G

2.2.2. Five samples of each colour which has been applied for;

2.2.3. 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:

2.2.3.1. 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.

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

2.3. Inscriptions

2.3.1. LED light sources submitted for approval shall bear on the cap:

2.3.1.1. The trade name or mark;

2.3.1.2. The rated voltage;

2.3.1.3. The designation of the relevant category;

2.3.1.4. A space of sufficient size to accommodate the approval mark.

2.3.2. The space mentioned in paragraph 2.3.1.4 above shall be indicated in the drawings accompanying the application for approval.

2.3.3. Inscriptions other than those covered by paragraphs 2.3.1 and 2.4.4 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 LED light source which are submitted in pursuance of paragraphs 2.2.2.3 or 2.2.3.2 above meet the requirements of this standard, approval shall be granted.

3. TECHNICAL REQUIREMENTS

3.1. Definitions

3.1.1. **Rated voltage**: Voltage (in volts) marked on the LED light source.

3.1.2. **Test voltage(s)**: Voltage(s) or voltage range(s), at the LED light sources terminals for which the electrical and photometric characteristics of the LED light sources are intended and are to be tested.

3.1.3 **Objective values**: Design value of an electrical or photometric characteristic. To be achieved, within the specified tolerances, when the LED light source is energized at relevant test voltage.

3.1.4. **Standard (étalon) LED light source**: Special LED 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. Standard LED light sources are specified in only one voltage rating for each category.

3.1.5. **Reference axis**: An axis defined with reference to the cap and to which certain dimensions of the LED light sources are referred.

3.1.6. **Reference plane**: A plane defined with reference to the cap perpendicular to the reference axis and to which certain dimensions of the LED light sources are referred.

3.1.7. **Light centre**: A point on the reference axis at a defined distance from the reference plane that represents the nominal origin of the visible radiation emitted.

3.1.8. **Light centre length**: The distance between the reference plane and the light centre.

3.1.9. **Viewing axis on to the LED light source**: An axis through the light centre at defined polar and azimuthal angle used to characterize photometrical properties of the LED light source.

3.1.10. **Apparent light emitting area**: Area that contains the (apparent) element of visible radiation when observed under a certain viewing axis. The apparent light emitting area is defined in a plane that contains the light centre and that is perpendicular to the corresponding viewing axis.

3.1.11. **Normalized luminous intensity**: Luminous intensity divided by the luminous flux of the light source in order to characterize the angular radiation pattern of the LED light source.

3.1.12. **Cumulative luminous flux**: luminous flux emitted by the light source under operating conditions, within a cone enclosing the specified solid angle and centered on the reference axis(1)

3.1.13. **Light emitting diode (LED) light source:** a light source where the element for visible radiation is one or more solid state junctions producing injection-luminescence and/or fluorescence

3.2. General specifications

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

3.2.2. 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.

3.2.3. LED light sources shall exhibit no scores or spots on their optical surfaces which might impair their efficiency and their optical performance.

3.2.4. LED light sources shall be equipped with standard caps complying with the cap data sheets of IEC Publication 60061 as specified on the individual data sheets of Annex A.

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

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(1) Based on CIE / IEC vocabulary IEV 845-09-31.

3.2.6. To ascertain whether LED light sources conform to the requirements of paragraphs 3.2.3 to 3.2.5 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.

3.2.7. The solid state junction(s) shall be the only element(s) of the LED light source that generate and emit light, either directly or via fluorescence-based conversion, when energized.

3.3. Tests

3.3.1. 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.

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

3.3.3. Electrical measurements as specified in Annex B shall be carried out with instruments of at least class 0.2 according to IEC 6005.

3.4. Position and dimensions of apparent light emitting area

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

3.4.2. The measurement shall be made after ageing the LED light source according to paragraph 3.3.1.

3.5. Luminous flux

3.5.1. When measured according to the conditions specified in Annex B, the luminous flux shall be within the limits given on the relevant data sheet of Annex A.

3.5.2. The measurement shall be made after ageing the LED light source according to 3.3.1.

3.6. Normalized luminous intensity distribution/ cumulative luminous flux distribution

3.6.1. When measured according to the test conditions specified in Annex B, the normalized luminous intensity distribution and/or cumulative luminous flux distribution shall be within the limits given on the relevant data sheet of Annex A.

3.6.2. The measurement shall be made after ageing the LED light source according to paragraph 3.3.1.

3.7. Colour

3.7.1. 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 AIS-010 (Part 5) (Rev. 1): 2010 and its amendments in force at the time of application for type approval shall apply to this standard.

3.7.2. The colour of the light emitted shall be measured by the method specified in Annex B. Each measured value shall lie within the required tolerance area.

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

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

Where:

$E_e(\lambda)$ (unit: W) is the spectral distribution of the irradiance;
$V(\lambda)$ (unit: 1) is the spectral luminous efficiency;
λ (unit: nm) is the wavelength.

This value shall be calculated using intervals of one nanometer.

3.8. 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:

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

Where:
$S(\lambda)$ (unit: 1) is the spectral weighting function;
k_m = 683 lm/W is the maximum value of the luminous efficacy of radiation.

(For definitions of the other symbols see paragraph 3.7.3. above).

This value shall be calculated using intervals of one nanometer. The UV radiation shall be weighted according to the values as indicated in the Table below:

λ	S(λ)	λ	S(λ)	Λ	S(λ)
250	0.430	305	0.060	355	0.00016
255	0.520	310	0.015	360	0.00013
260	0.650	315	0.003	365	0.00011
265	0.810	320	0.001	370	0.00009
270	1.000	325	0.00050	375	0.000077
275	0.960	330	0.00041	380	0.000064
280	0.880	335	0.00034	385	0.000053
285	0.770	340	0.00028	390	0.000044
290	0.640	345	0.00024	395	0.000036
295	0.540	350	0.00020	400	0.000030
300	0.300				

Note: Values according to "IRPA/INIRC Guidelines on limits of exposure to ultraviolet radiation". Wavelengths (in nanometers) chosen are representative; other values should be interpolated.

3.9. Standard LED light sources

Additional requirements for standard (étalon) LED light sources are given on the relevant data sheets of Annex A.

3.10 If a LED light source type approved as per this standard is used in a device, while approving the device to applicable parts of AIS-010 (Rev.1): 2010 or AIS-012(Rev1) :2011, as amended from time to time, the UV test prescribed in such standards need not be conducted.

4. CONFORMITY OF PRODUCTION

The conformity of production procedures shall comply with those set out in the AIS-037, as amended from time to time, with the following requirements:

4.1. LED light sources approved to this standard 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 A, B and C to this standard.

4.2 The minimum requirements for quality procedures set forth in Annex F to this standard shall be complied with.

4.3. The testing agency may carry out any tests prescribed in this standard. Where the testing agency decides to carry out spot checks, criteria of Annexes E and F to this standard shall be applied.

4.4 The normal frequency of inspection by the authorised testing agency shall be once every two years.

5. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

The penalties for non-conformity of production shall be as per AIS-037

6. TRANSITIONAL PROVISION

6.1 At the request of the applicant, type approvals for compliance to this standard shall be granted by test agencies from (date of adoption in CMVR-TSC). In such a case the applicability of AIS-037 is deemed to be mandatory from the date of adoption of this standard.

7. EXTENSION OF TYPE APPROVAL

7.1 Every modification pertaining to the information, even if changes are not technical in nature declared in accordance with 2.2.1 shall be intimated by manufacturers to the testing agency.

If the changes are in parameters not related to the provisions, no further action need to be taken.

If the changes are in parameters related to the provisions, the testing agency, which has issued the certificate of compliance, shall then consider, whether,

7.1.1 The LED light source with the changed specifications still complies with the provisions, or

7.1.2 Any further verification is required to establish compliance.

7.2 For considering whether testing is required or not, guidelines given in the 7.5 (Criteria for Extension of Approval) shall be used.

7.3 In the case of 7.1.2, tests for only those parameters which are affected by the modifications need to be carried out.

7.4 In the case of fulfillment of criterion of 7.1.1 or after results of further verification as per 7.1.2 are satisfactory, the approval of compliance shall be extended for the changes carried out.

7.5 **Criteria for Extension of Approval**

The criteria shall be as agreed between the test agency and the applicant.

8. ESTABLISHING COMPLIANCE OF "E"/"e" APPROVED LED LIGHT SOURCE TO THIS STANDARD

As an exception to 7.4 of AIS-037, (or related administrative decisions) for certifying compliance of "E"/"e" approved LED light source to this standard shall comply, the test for objective values Luminous flux as specified in relevant specification.

9. AMENDMENTS TO UN REGULATIONS AFTER THE LEVEL DESCRIBED IN 0.3 OF INTRODUCTION

Acceptance of changes in UN regulations after the level described in 0.3 of introduction shall be as per AIS-000, as amended from time to time, as applicable, unless otherwise stated.

ANNEX A

(See clause 1 and 3)

SHEETS* FOR LED LIGHT SOURCES

List of categories of LED light sources and their sheet numbers:

Category	Sheet number(s)
LR1	LR1/1 to 5
LW2	LW2/1 to 5

List of sheets for LED light sources and their sequence in this annex:

Sheet number(s)
LR1/1 to 5
LW2/1 to 5

* Tables, Electrical and Photometric characteristics:
Voltage is expressed in V;
Wattage is expressed in W;
Luminous flux is expressed in lm;
Normalized luminous intensity is expressed in cd/1000 lm.
Normalized cumulative luminous flux is expressed in %

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

Figure 1
Main Drawing

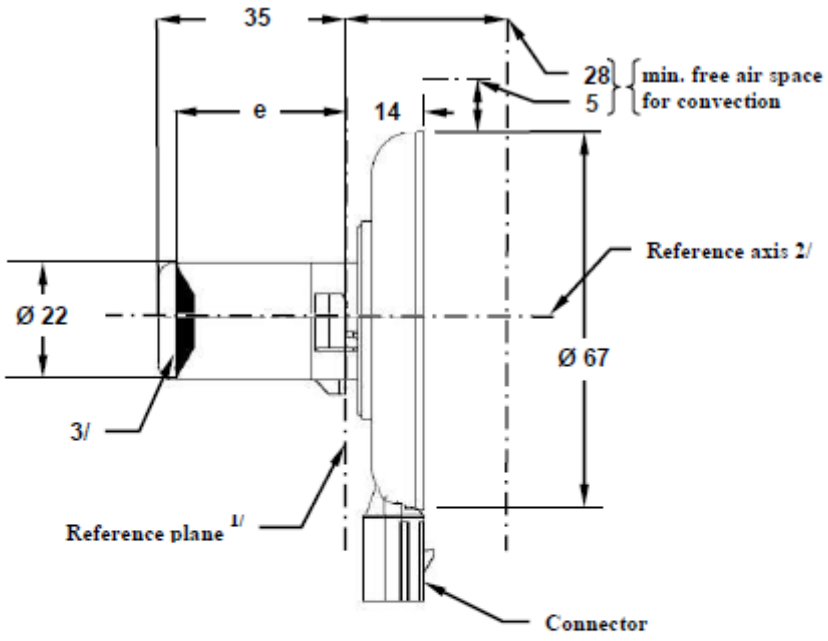
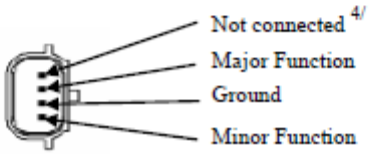


Figure 2
Connector detail



1/ The reference plane is the plane defined by the contact points of the cap-holder fit.
2/ The reference axis is perpendicular to the reference plane and passing through the centre of the bayonet core.
3/ Light emitting area: to be checked by means of the box system in Figure 3.
4/ Optional pin.

Table 1

The table is intended to specify the essential electrical and photometric characteristics of the LED light source (LR1)

Dimensions in mm		Tolerance	
		LED light sources of normal production	Standard LED light source
e[3/]	24.0	0.2	0.1
Cap PGJ21t-1 in accordance with IEC Publication 60061 (sheet 7004-165-1)			
Electrical and Photometric Characteristics[5/]			

Rated Values		Minor Function	Major Function	Minor Function	Major Function
	Volts	12		12	
Objective Values[6/]	Watts (at 13.5 V DC)	0.75 max.	3.5 max. 1.4 min.	0.75 max.	3.5 max. 1.4 min.
	Luminous flux (in lm at 13.5V DC)			3.5 ± 10%	47 ± 10%
	Luminous flux (in lm at 10-16 V DC)	3.5 ± 20%	47 ± 20%		

5/ The emitted light shall be red.
6/ Continuous on for 30 minutes at 23 ± 2.5° C.

Failure condition behavior
In case of LED light source failure (no light emitted) the maximum current draw – when operated within the input voltage range in major function mode – operation shall be less than 20 mA (open circuit condition).

Screen projection requirements
The following test is intended to define the requirements for the apparent light emitting area of the LED light source and to determine whether the light emitting area is correctly positioned relative to the reference axis and reference plane in order to check compliance with the requirements.

The position of the light emitting area is checked by the box system defined in Figure 3, which shows the projections when viewing along direction γ=90º in the planes C_{90} and C_{180} (C, γ as defined in Figure 4). At least 95 per cent of the luminous flux emitted into the viewing direction has to come from the trapezoidal area defined by d1, d2 and c. Less than 70 per cent of the luminous flux shall be emitted from the rectangular area defined by d3 and c.

Figure 3
Box definition of the light emitting area

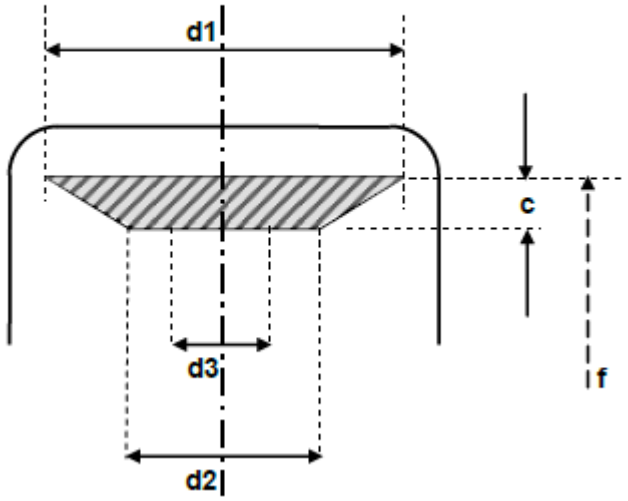


Table 2

Dimensions of the box system in Figure 3

Dimensions in mm	F	c	d1	d2	d3
LED light sources of normal production	E+0.2	3.6	21.0	15.0	7.0
Standard (etalon) LED light sources	E+0.1	3.4	21.0	15.0	7.0

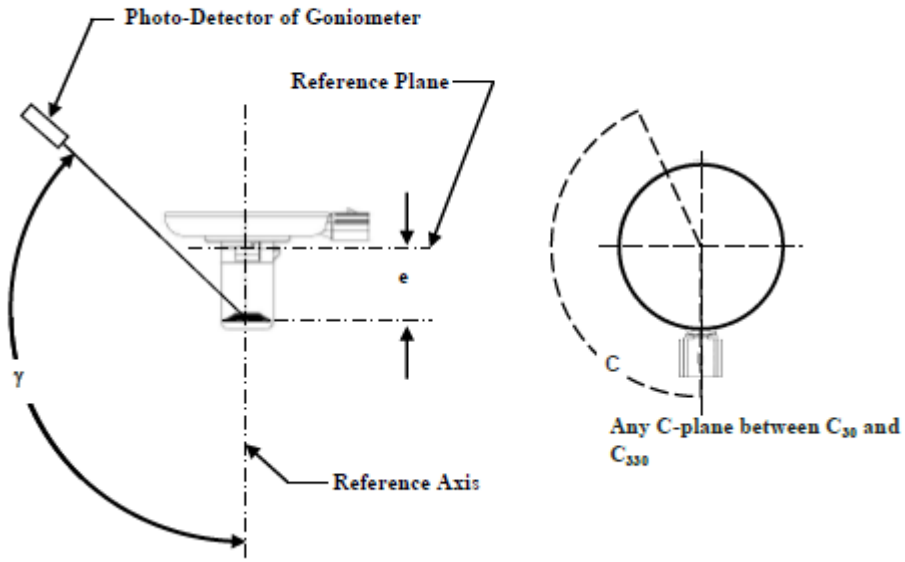
Normalized luminous intensity distribution

The following test is intended to determine the normalized luminous intensity distribution of the light source in an arbitrary plane containing the reference axis. The intersection of the reference axis and the upper edge of the box is used as the coordinate system origin.

The light source is mounted on a flat plate with the corresponding mounting lug features. The plate is mounted to the goniometer table by a bracket, so that the reference axis of the light source lines up with one of the rotating axis of the goniometer. The corresponding measurement set-up is described in Figure 4.

The drawings are intended only to illustrate the essential set-up for measurement of the LED light source.

Figure 4
Set-up to measure the luminous intensity distribution



Luminous intensity data is recorded for the major function with a standard photo goniometer.

The measurement distance should be chosen appropriately, to make sure that the detector is located in the far field of the light distribution.

The measurements shall be performed in 3 C-planes, which contain the reference axis of the light source. The 3 C-planes shall be within C_{30} and C_{330} to avoid the connector shadows and they have to be at least 30º apart from each other. The test points for each plane for multiple polar angles γ are specified in Table 3.

After measurement the data shall be normalized to 1000 lm according to paragraph 3.1.11 using the luminous flux of the individual light source under test. The data shall comply with the tolerance band as defined in Table 3.

C-planes: see CIE publication 70-1987, "The measurement of absolute intensity distributions".

Table 3

Test point values of normalized intensity for the major function of normal production and standard light sources, respectively.

	LED light source of normal production		Standard LED light source	
γ	Minimum Intensity in cd/1000 lm	Maximum Intensity in cd/1000 lm	Minimum Intensity in cd/1000 lm	Maximum Intensity in cd/1000 lm
0°	0	30	0	20
15°	0	30	0	20
30°	0	70	0	40
45°	20	100	20	60
60°	35	120	35	80
75°	50	140	50	100
90°	70	160	70	120
105°	80	180	90	140
120°	110	200	110	160
135°	110	200	110	160
150°	90	180	90	140

The luminous intensity distribution as described in Table 3 shall be substantially uniform, i.e. in between two adjacent grid points the relative luminous intensity requirement is calculated by linear interpolation using the two adjacent grid points.

The drawings are intended only to illustrate the essential dimensions (in mm) of the LED light source

Figure 1
Main drawing- front and side view

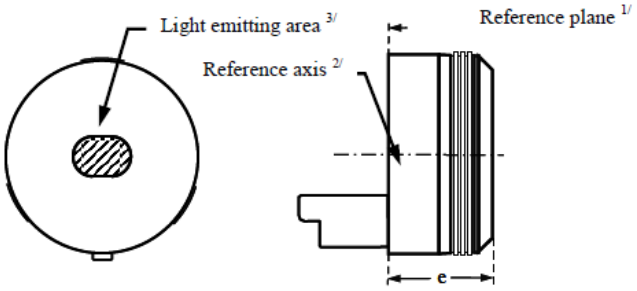


Figure 2 – Connector Detail

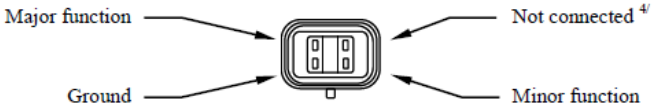


Table 1
Essential electrical and photometric characteristics

Dimensions in mm		Tolerance			
		LED light sources of normal production		Standard LED light source	
e 3/	26.4	0.2		0.1	
[Cap PGJY50] in accordance with IEC Publication 60061 (sheet 7004-[….]-1)					
Electrical and Photometric Characteristics 5/					
Rated Values		Minor Function	Major Function	Minor Function	Major Function
	Volts	12		12	
Objective Values 6/7	Watts (at 13.5 V DC)	1 max	12 max 4 min.	1 max	12 max 4 min.
	Luminous flux (in lm at 13.5V DC)			50 ± 10%	725 ± 10%
	Luminous flux (in lm at 10-16 V DC)	50 ± 15%	725 ± 15%		
Corresponding base temperature Tb in °C		30 ± 2	55 ± 2	30 ± 0.5	55 ± 0.5

1/ The reference plane is given by the thermal transfer area on the backside of the light source.
2/ The reference axis is perpendicular to the reference plane and passing through the centre of the light source as defined by three notches on the outer perimeter.
3/ Light emitting area: to be checked by means of the box system in Figure 3.
4/ Optional pin.
5/ The emitted light shall be white.
6/ Continuous operation for 30 minutes with base temperature Tb stabilized as specified above.
7/ Luminous flux from the light emitting area shall be determined within a solid angle of $40° < \alpha < +40°$ and $40° < \beta < +40°$ using either integral methods or the procedure described on sheets LW2/3 and LW2/4.

Screen projection requirements

This test is intended to determine whether the light emitting area of the LED light source is correctly positioned relative to the reference axis and reference plane.

Compliance of position and dimension as defined in Table 2 is checked by the box system shown in Figure 3. The left drawing displays the projection when viewing along the reference axis with an aperture acceptance angle of ±40° while the right drawing defines the position of the reference plane and axis.

Size determination shall be done with suitable means.

Figure 3
Box definition of light emitting area

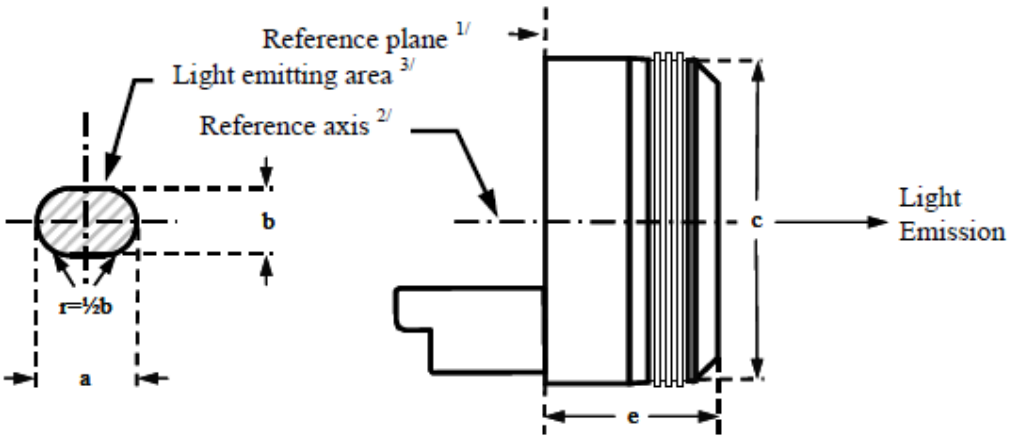


Table 2
Dimension of the light emitting area in Figure 3

Dimensions in mm	e	a	b	c
LED light sources of normal production	26.4 ± 0.2	14.5 +0/ -2.5	10.1 +0/ -1.5	Ø 50.00 + 0.10/ -0
Standard (etalon) LED light sources	26.4 ± 0.1	14.5 +0/ -2.5	10.1 +0/ -1.5	Ø 50.05 + 0.05/ -0

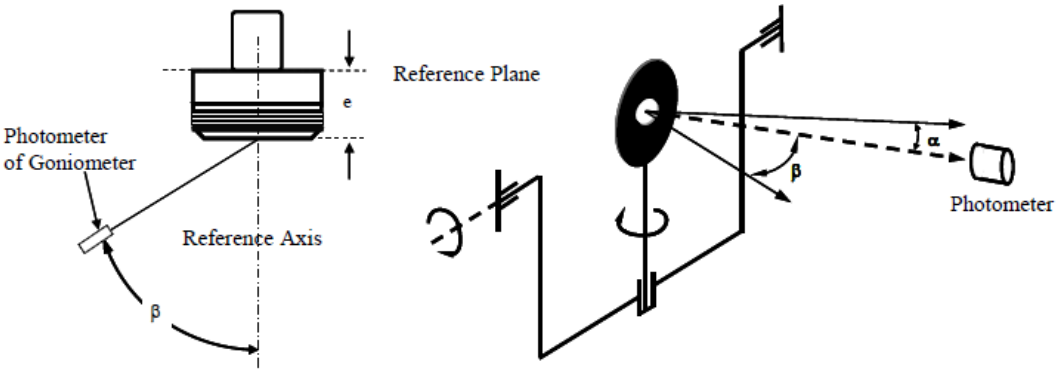
Cumulative luminous flux distribution

Measurement set-up

This test is intended to determine the cumulative luminous flux within defined solid angles of the luminous intensity distribution.

Goniophotometers of type I or II according to CIE publication No. 70 -1987 with the capability of turning the light source around two axes perpendicular to the axis of light emission can be used. The intersection of the reference axis and the parallel plane to the reference plane in distance e is used as the coordinate system origin.

Figure 4
Set-up to measure the luminous intensity distribution using a type I Photogoniometer



The light source is mounted on a flat plate with the corresponding mounting lug features. The plate is mounted to the goniometer table by a bracket in such way, that the reference axis of the light source lines up with the measurement axis of the goniometer. The corresponding measurement set-up is described in Figure 4.

Cumulative luminous flux distribution

Measurement and calculation procedure
Data shall be recorded for the specified base temperature Tb from Table 1 at the location shown in Fig. 5.

Luminous intensity distribution data shall be recorded within a solid angle of $-40° < \alpha < +40°$ and $-40° < \beta < +40°$. The measurement distance shall be chosen in such manner that the detector is located in the far field of the light distribution. An angular step size of 1° or less is required.

After the measurement, the cumulative luminous flux distribution shall be calculated from the recorded data for various solid angles as specified in Table 3 according to CIE publication 84-1989, section 4.3. Subsequently, the distribution shall be normalized to the total luminous flux determined for $-40° < \alpha < +40°$ and $-40° < \beta < +40$. The data shall comply with the tolerance band defined in Table 3.

In order to secure a symmetrical distribution within each solid angle in Table 3 the luminous flux determination shall be done independently for all 4 quadrants and flux values shall not differ by more than 15%.

Table 3
Test point values of normalized cumulative luminous flux for both normal production and standard lamps

Angle α, β	Min. normalized flux in %	Max. normalized flux in %
$-5° < \alpha, \beta < +5°$	8	14
$-10° < \alpha, \beta < +10°$	31	37
$-15° < \alpha, \beta < +15°$	54	59
$-20° < \alpha, \beta < +20°$	75	81
$-25° < \alpha, \beta < +25°$	91	95
$-30° < \alpha, \beta < +30°$	97	100
$-35° < \alpha, \beta < +35°$	98	100
$-40° < \alpha, \beta < +40°$	100 (by definition)	

The cumulative luminous flux distribution of the minor function may be verified by measuring the ratio of major and minor function under a fixed angle and multiplication of this factor with the luminous flux of the major function.

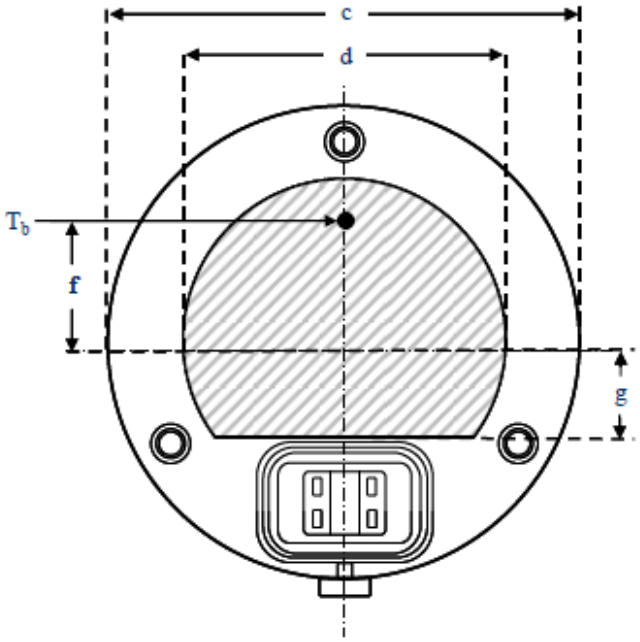
In case of doubt that cumulative luminous flux distributions of major and minor function differ, the procedure as described above for the major function shall be repeated for the minor function.

Thermal interface geometry

The LW2 thermal interface is located within the reference plane (shaded area in Figure 5) and described in detail in IEC Publication 60061 as indicated in Table 1 on sheet LW2/1. It shall be attached to an appropriate heat sink or thermal management system.

The luminous flux given in Table 1 shall be achieved once the base temperature Tb measured at the location shown in Figure 5 is stabilized.

Figure 5
Rear-view: thermal contact area and location of Tb-point on the vertical symmetry axis, at a distance f from the center



Dimensions in mm	
c	50.0
d	34.5
f	13.0
g	10.0

Failure condition behavior

In case of LED light source failure (no light emitted) the maximum current draw – when operated within the input voltage range in major function mode – shall be less than 20 mA (open circuit condition).

ANNEX B
(See clause 3)

METHOD OF MEASUREMENT OF ELECTRICAL AND PHOTOMETRICAL CHARACTERISTICS

Light sources of all categories with integrated heat sink shall be measured at ambient temperature of (23 ± 2) °C in still air. For these measurements the minimum free space as defined in the data sheets shall be maintained.

Light sources of all categories with definition of a temperature Tb shall be measured by stabilizing the Tb-point at the specific temperature defined on the category data sheet.

B.1 Luminous flux

B.1.1 A luminous flux measurement using an integrating method shall be made

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

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

B.1.2 The luminous flux values, as measured after

(a) 30 minutes, or

(b) Stabilization of temperature Tb

Shall comply with the minimum and maximum requirements.

In case of (a), this value shall be in between 100 per cent and 80 per cent of the value measured after 1 minute.

B.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 behavior shall be substantially uniform.

B.2 Normalized luminous intensity/ cumulative luminous flux

B.2.1 The luminous intensity measurements shall be started after

a) 30 minutes of stabilization time or

b) Stabilization of temperature Tb at the value given in the relevant data sheet.

B.2.2 Measurements have to be carried out at relevant test voltage.

B.2.3 Normalized luminous intensity of a test sample is calculated by dividing the luminous intensity distribution as measured under paragraph B.2.1 of this annex by the luminous flux as determined after 30 minutes under paragraph B.1.2 of this annex.

B.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 within a cone enclosing a solid angle.

B.3 Colour

The colour of the light emitted as measured under the same conditions as described paragraph in B.1.1 of this annex shall both be within the required colour boundaries.

B.4 Power consumption

B.4.1 A power consumption measurement shall be made under the same conditions as described in paragraph B.1.1 of this annex using the requirements of paragraph 3.3.3 of this Standard.

B.4.2 Power consumption measurements shall be carried out at relevant test voltage.

B.4.3 Values obtained shall comply with the minimum and maximum requirements of the relevant data sheet.

ANNEX C
(see clause 4)

MINIMUM REQUIREMENTS FOR QUALITY CONTROL PROCEDURES BY THE MANUFACTURER

C.1 General

The conformity requirements shall be considered satisfied from a photometric, geometrical, visual and electrical standpoint if the specified tolerances for production LED light sources in the relevant data sheet of Annex A and the relevant data sheet for the caps are met.

C.2 Minimum requirements for verification of conformity by the manufacturer

For each type of LED light source the manufacturer or the holder of the approval mark shall carry out tests, in accordance with the provisions of this Standard, at appropriate intervals.

C.2.1 Nature of tests

Tests of conformity of these specifications shall cover their photometric, geometrical and optical characteristics.

C.2.2 Methods used in tests

C.2.2.1 Tests shall generally be carried out in accordance with the methods set out in this Standard.

C.2.2.2 The application of paragraph C.2.2.1 of this annex requires regular calibration of test apparatus and its correlation with measurements made by a testing agency.

C.2.3 Nature of sampling

Samples of LED light sources shall be selected at random from the production of a uniform batch. A uniform batch means a set of LED light sources of the same type, defined according to the production methods of the manufacturer.

C.2.4 Inspected and recorded characteristics

The LED light sources shall be inspected and test results recorded following the grouping of characteristics as listed in Annex D, Table 1.

C.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 4.1of this Standard.

Compliance shall be assured if the level of acceptable non-compliance per grouping of characteristics given in Table 1 of Annex D is not exceeded. This means that the number of LED light sources not complying with the requirement for any grouping of characteristics of any LED light sources type does not exceed the qualifying limits in the relevant Tables 2, 3 or 4 of Annex D.

Note: Each individual LED light source requirement shall be considered as a characteristic.

ANNEX D
(See Annex C)

SAMPLING AND COMPLIANCE LEVELS FOR MANUFACTURER TEST RECORDS

Table 1
Characteristics

Grouping of Characteristics	Grouping* of Test Records between Lamp Types	Minimum twelve monthly sample per grouping*	Acceptable level of non-compliance per grouping of characteristics (%)
Marking, legibility and durability	All types with same external dimensions	315	1
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 light emitting surface and internal elements**	All lamps of one type	200	6.5
Initial readings, colour, power and luminous flux**	All lamps of one type	200	1
Normalized luminous intensity distribution or cumulative luminous flux distribution	All lamps of one type	20	6.5

* The assessment shall in general cover series production LED light sources 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 LED light source has more than one light output function the grouping of characteristics (dimensions, power, colour and luminous flux) applies to each element separately.

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 characteristic	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
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 noncompliance.

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
20	3	500 – 512	44	881 - 893	72
21 – 32	5	513 – 526	45	894 - 907	73
33 – 50	7	527 – 540	46	908 - 920	74
51 – 80	10	541 – 553	47	921 - 934	75
81 – 125	14	554 – 567	48	935 - 948	76
126 – 200	21	568 – 580	49	949 - 961	77
201 – 213	22	581 – 594	50	962 - 975	78
214 – 227	23	595 – 608	51	976 - 988	79
228 – 240	24	609 – 621	52	989 - 1,002	80
241 – 254	25	622 – 635	53	1,003 -,1016	81
255 – 268	26	636 – 648	54	1,017 - 1,029	82
269 – 281	27	649 – 662	55	1,030 - 1,043	83
282 – 295	28	663 – 676	56	1,044 - 1,056	84
296 – 308	29	677 – 689	57	1,057 - 1,070	85
309 – 322	30	690 – 703	58	1,071 - 1,084	86
323 – 336	31	704 – 716	59	1,085 - 1,097	87
337 – 349	32	717 – 730	60	1,098 - 1,111	88
350 – 363	33	731 – 744	61	1,112 - 1,124	89
364 – 376	34	745 – 757	62	1,125 - 1,138	90
377 – 390	35	758 – 771	63	1,139 - 1,152	91
391 – 404	36	772 – 784	64	1,153 - 1,165	92
405 – 417	37	785 – 798	65	1,166 - 1,179	93
418 – 431	38	799 – 812	66	1,180 - 1,192	94
432 – 444	39	813 – 825	67	1,193 - 1,206	95
445 – 458	40	826 – 839	68	1,207 - 1,220	96
459 – 472	41	840 – 852	69	1,221 - 1,233	97
473 – 485	42	853 – 866	70	1,234 - 1,249	98
486 – 499	43	867 – 880	71		

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 noncompliance	Qualifying limits shown as a percentage of results. Acceptable level of 6.5 % of noncompliance
1,250	1.68	7.91
2,000	1.52	7.61
4,000	1.37	7.29
6,000	1.3	7.15
8,000	1.26	7.06
10,000	1.23	7
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 E
(See clause 4)

MINIMUM REQUIREMENTS FOR SPOT CHECKS BY THE TYPE APPROVAL AUTHORITY

E.1 General

The conformity requirements shall be considered satisfied from a photometric, geometrical, visual and electrical standpoint if the specified tolerances for production LED light sources in the relevant data sheet of Annex A-and the relevant data sheet for the caps are met.

E.2 The conformity of mass-produced LED light sources shall not be contested if the results are in agreement with Annex F to this Regulation Standard.

E.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 F to this Standard.

E.4 If paragraph E.3. of this annex is applied, a further sample of 250 LED light sources, selected at random from a recent production run, shall be taken within two months.

ANNEX F
(see clause 4)

COMPLIANCE APPROVED BY SPOT CHECK

Compliance approved or disapproved shall be decided according to the values in Table 1.
For each grouping of characteristics LED light sources shall be either accepted or rejected according to the values in Table 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 proposed scheme is designed to assess the compliance of LED light sources 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.

** The LED light sources shall be inspected and test results recorded following the grouping of characteristics as listed in Annex D, Table 1.

ANNEX G
(See clause 2.2.1)

INFORMATION TO BE SUBMITTED AT THE TIME OF APPLICATION FOR TYPE APPROVAL

1. Trade name or mark :
2. Manufacturer's name for the type of LED light source:
3. Manufacturer's name and address:
4. If applicable, name and address of manufacturer's representative:
5. Drawings in triplicate, sufficiently detailed to permit identification of the type and a brief technical description including -

5.1. Category of LED light source:

5.2. Rated voltage:

5.3. Rated wattage:

5.4. Colour of the light emitted: White/ red (see Note 2 below)

5.5. Position of the approval mark:

6.0. Reason(s) for extension (if applicable):

Note 1 See 2.2.3 for cases where there is a change in the trade mark.
Note 2 Strike out what does not apply.

ANNEX H
(See Introduction)

COMPOSITION OF AISC PANEL ON LIGHTING AND LIGHT-SIGNALLING DEVICES*

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Mr. P. N. Bhagwan	Auto Bulbs (AIAMBCMA)

* At the time of approval of this Automotive Industry Standard (AIS)

ANNEX-I
(See Introduction)
COMMITTEE COMPOSITION *
Automotive Industry Standards Committee

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