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Automotive headlamps with LED light sources and/or LED modules

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Foreword

Chapter 5 (except for 5.10) and Chapter 6 (except for 6.8) of this standard are mandatory, AND the rest of this standard is recommended.

The Appendix A, Appendix B, Appendix C of this standard are normative.

This standard was proposed by the National Development and Reform Commission of the People's Republic of China.

This standard shall be under the jurisdiction of the National Automotive Standardization Technical Committee (SAC/TC 114).

The drafting organizations of this standard: China Automotive Technology Research Center, Shanghai Automotive Lighting Research Institute, Tianjin Automotive Light Factory, Philips (China) Investment Co., Ltd., Changchun Hella Lights Co., Ltd., Osram (China) Lighting Co., Tianjin Polytechnic University Haiyu Semiconductor Lighting Co., Ltd., Shanghai Xiaosi Automotive Light Co., Ltd., Changzhou Xingyu Automotive Light Co., Ltd.

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Automotive headlamps with LED light sources and/or LED modules

1 Scope

This standard specifies the test methods and inspection rules for the light distribution performance, light color, temperature cycle of the automotive headlamps with LED light source or LED light source/module.

This standard applies to the LED headlamps used for category M and N automotive, OR the LED headlamps mainly using the LED light source or LED module to generate a high beam or low beam.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For the dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard; however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB 4599-2007 Motor vehicle headlamps equipped with filament lamps

GB 4785 Prescription for installation of the external lighting and light signaling devices for motor vehicles and their trailers

GB/T 7922 Method of measuring the color of light sources

GB 15766.1 Filament lamps for road vehicles - Dimensional, electrical and luminous requirements

3 Terms and definitions

The terms and definitions as established in GB 4599-2007 and GB 4785 as well as the following terms and definitions apply to this standard.

3.1

Objective luminous flux

The design value of the luminous flux of the replaceable light source OR light source module.

3.2

Failure of light source

The phenomenon of loss of lighting function, darkening, chroma exceeding criteria, or flashing of one or more LED during the normal use of LED or LED module.

3.3

LED module

Light source module containing LED only.

4 Different types of headlamps

Headlamps that differ in the following main areas:

- Product name or trademark;
- Optical system characteristics;
- Components to change the optical effect by reflection, refraction, absorption and/or deformation at work;
- Light beam types provided (low beam, high beam, or high and low beam);
- Lens and its coating material.
- LED light source/module type and parameters (voltage, power, luminous flux, chroma, and color rendering performance).

5 Requirements

5.1 General requirements

5.1.1 LED headlamp shall be so designed and manufactured that under normal conditions of use, even if subjected to vibration, it can still comply with the requirements and comply with the provisions of this standard.

5.1.2 LED headlamps shall have good heat dissipation, to prevent heat accumulation of LED light source. LED headlamp can work normally even in low temperature freezing environment.

5.1.3 LED headlamps shall have good electromagnetic compatibility.

5.1.4 When the headlamp is equipped with LED light source or LED module, its performance shall comply with the requirements of this standard; when the LED headlamp is equipped with filament lamps or HID light source to achieve high beam or low beam function, its light distribution performance and testing shall comply with the requirements of their respective standards.

5.1.5 The headlamps shall have beam adjustment device. When the low beam and high beam form a combination AND each has an LED light source/module,

6 Test methods

6.1 Test darkroom, device and equipment

6.1.1 Test darkroom shall be free from light leakage, AND its environmental conditions shall not affect the beam transmission and instrument accuracy.

6.1.2 The light distribution screen shall be wide enough to facilitate the inspection and adjustment of the low beam cut-off line; the color of the light distribution screen shall facilitate beam aiming, AND it shall eliminate the stray light effect during light distribution test.

6.1.3 Light distribution test shall use DC power supply, electrical instrumentation accuracy is not less than 0.2, AND the illuminometer shall be the level I illuminometer as specified in the national verification procedures (its indication error does not exceed $\pm 4\%$).

6.2 Test environment

As for the photoelectrical performance test, the test environment temperature is $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ AND the relative humidity is 20% ~ 80%

6.3 Light distribution test

6.3.1 Before the test, the headlamp LED module shall be aged for 15 h AND then cooled to room temperature.

6.3.2 Unless otherwise specified, the voltage during the light distribution test is $13.2\text{ V} \pm 0.1\text{ V}$ ($28.0\text{ V} \pm 0.1\text{ V}$ for nominal voltage 24 V). When using the electronic light source controller, it shall be tested in accordance with the manufacturer's parameters.

6.3.3 Lamps shall be lit continuously in accordance with Appendix B until the light reaches to steady state before the test.

6.3.4 Low beam aiming

6.3.4.1 In the vertical direction, the horizontal part of the cut-off line shall be located 25 cm below the h-h line;

6.3.4.2 In the horizontal direction, the transition point of the cut-off line shall be located on the line v-v. If the transition point is not clear, the illumination value at 75 R and 50 R shall prevail.

6.3.4.3 In order to make the cut-off line clear and visible during aiming, it is allowed to shield part of the lens.

6.3.4.4 The aiming is confirmed by visual checking of the cut-off line within the range 5° (219 cm) at both sides of v-v line.

6.3.6.5 Where the manufacturer does not specify the position of use of the reflector, the test shall be carried out in accordance with the provisions of 6.3.6.1 to 6.3.6.2 at the average adjustment position of the reflector. Then the reflector is moved to the maximum adjustment position to be subjected to the additional test in accordance with the provisions of 6.3.6.3.

6.3.7 The actual measured value of LED headlamp light distribution is multiplied by 0.7 to obtain the illumination value of each test point/zone.

6.3.8 If a certain functional light distribution of the LED headlamp (high beam or low beam) is obtained jointly by LED module and filament lamp, they shall be measured respectively AND the results summed.

6.4 Light color test

In accordance with the measurement method of the lighting source color in GB/T 7922, after aiming (for 1 min or after stabilization), the low beam is directly measured at 50 V AND the high beam is measured at HV point. The voltage at the time of measurement is based on the light distribution test voltage.

6.5 Light distribution stability of LED headlamp

Test methods are as shown in Appendix A.

6.6 LED headlamp illumination and color temperature stability

Test methods are as shown in Appendix B.

6.7 LED headlamp plastic lens and plastic optical components

6.7.1 Lens or material sample and whole lamp test of plastic lens headlamp

Lens or material sample and whole lamp test of plastic lens headlamp is as shown in Appendix B of GB 4599-2007. However, in case where the light source is lit during the test, the headlamp built-in light source is used and lit up at test voltage.

6.7.2 LED headlamp plastic material components anti-UV radiation

Respectively TAKE each of the relevant plastic parts for the headlamp or the headlamp samples containing the plastic optical components, MAKE it be irradiated continuously by the light emitted from the LED module for 1500 hours. If using the optical components are used for the test, the position of each relevant plastic part sample as relative to the LED module shall be same as its angle and distance in the headlamp.

6.8 LED headlamp temperature cycling test

Test methods are as shown in Appendix C.

Appendix A

(Normative)

LED headlamp light distribution stability test

A.1 Light distribution stability test

The test shall be carried out in dry, still air at a temperature of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. The whole lamp shall be mounted on a support that correctly indicates its installation position.

A.1.1 Clean headlamps

The headlamp shall be turned on for 12 h in accordance with the provisions of A.1.1.1 AND inspected in accordance with the provisions of A.1.1.2.

A.1.1.1 Test methods

The headlamp shall be lit up in the following manner:

A.1.1.1.1 The functional combination is as follows:

- a) For high beam or low beam, the corresponding filament/LED module is lit up for 12 h²⁾;
- b) When low beam and high beam are combined (double filament lamps or two filament lamps/LED modules):
 - 1) If the manufacturer prescribes one filament/LED module is lit up in each use of the headlamp³⁾, then the low beam filament/LED module and high beam filament/LED module is lit up for 6 h in order;
 - 2) In all other cases ^{2), 3)}, the low beam filament/LED module is lit up for 15 min and all filament/LED modules are lit up for 5 min; totally lit up for 12 h;
- c) For the case of combined lighting function:

In accordance with the requirements of item a), all individual functions are lit at the same time to the specified time; in accordance with the requirements of the manufacturer, it is also possible to consider using the lighting method of the combined lighting function b).

² When the tested headlamp is combined with the signaling lamp and/or mixed, the signaling lamp shall be lit up during the test period. As for the turning indication lamp, it shall be lit up in the manner of flashing, AND the lit up and off time ratio is about 1:1.

³ When the headlamp works in the flashing manner, the filaments of two or more lamps are lit up at the same time, BUT this is not the normal use conditions of filament.

- 0.2 parts of NaCMC⁴⁾ and a suitable amount of distilled water (conductivity of less than 1 mS/m).

The test mixture is valid for up to 14 days.

A.1.2.2.2 For plastic lens headlamp

The composition of the test mixture (weight ratio) applied to the headlamp lens is as follows:

- 9 parts of silica sand with particle size between 0 ~ 100 µm;
- 1 part of plant carbon powder with particle size of 0 ~ 100 µm;
- 0.2 parts of NaCMC;
- 13 parts of distilled water (conductivity less than 1 mS/m);
- (2 ± 1) parts of surfactant.

The amount tolerance of surfactant used shall allow the test mixture to spread throughout the lens. The test mixture is valid for up to 14 days.

A.1.2.3 Test mixture coating

The test mixture shall be evenly applied to the entire light transmission surface of the headlamp. After drying, the coating shall be applied repeatedly until the illumination value of the high beam $E_{\max}$, low beam 50R and 50V drops to 15% ~ 20% of the initial value.

A.1.2.4 Measuring equipment

It shall use the measuring equipment similar to those used for type test. As for the semi-enclosed headlamps, it shall use the standard filament lamps for the measurement of the light distribution performance.

A.2 Test of cut-off line vertical position change under the effect of heating

This test is used to check whether the vertical offset of the low beam cut-off line exceeds the specified value under the effect of heating.

The headlamps tested in accordance with A.1 shall be tested in accordance with the provisions of A.2.1 without being removed from the test stand OR without readjustment.

A.2.1 Test

⁴ NaCMC represents carboxymethylcellulose sodium salt, generally expressed as CMC. As for the NaCMC used in the test mixture at 20 °C, the 2% solution substitution degree (DS) is 0.6 ~ 0.7 AND the viscosity is 200 cp ~ 300 cp.

Appendix B

(Normative)

LED headlamp illumination and color temperature stability test

B.1 illumination

B.1.1 As for the illumination of the headlamp, it shall measure the following test points after a certain function is lit up for 1 min. During the test, it may make approximate aiming, BUT such aiming position shall always be maintained before finishing the ratio measurement.

Test point:

Low beam 50 V

High beam HV

B.1.2 The lamps shall be continuously illuminated until the steady state of luminosity appears: the photometric variation of the test point required by B.1.1 is less than 3% within 15 min.

When a steady state is reached, RECORD the luminosity of the test point required by B.1.1 and MAKE aiming in accordance with the requirements of 6.3.4 or 6.3.5, to perform photometric measurements at all test points.

B.1.3 CALCULATE the ratio in accordance with the photometric value at the test points of B.1.1 and B.1.2.

B.1.4 This calculated ratio is applied to all test points to calculate the luminosity of all test points after lighting up for 1 min.

B.1.5 Illumination values measured at 1 min and after photometric stability shall comply with the requirements of maximum and minimum values.

B.2 Light color

After lighting up for 1 min and photometric stability as described in B.1.2 is reached, MAKE light color measurement, AND the light color shall be within the required range.

B.3 Measurement of objective luminous flux of low beam LED module

B.3.1 The appearance of the LED module shall comply with the description of the technical specification as specified in 7.3. Secondary optical components shall be removed. This process and the test conditions described below shall be recorded in the test report.

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