C-NCAP MANAGEMENT REGULATION

(2021 EDITION)

APPENDIX D

TESTING METHOD FOR VEHICLE-LEVEL LIGHT PERFORMANCE

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D.1 VEHICLE PREPARATION

D.1.1 Vehicle running-in

Before the vehicle is tested, a running-in of not less than 1,000 km is required.

D.1.2 Vehicle cleaning

Before the vehicle enters the laboratory, it shall be cleaned and dried by external car washing, and foreign matters in tire tread shall be removed to prevent dust and stains from polluting the light distribution darkroom and affecting the accuracy of headlamp test results. The outer surface of headlamps shall be also cleaned to assure the accuracy of headlamp test results.

D.1.3 Curb weight

D.1.3.1 Fill in the fuel tank to the rated volume.

D.1.3.2 Check whether other liquids (e.g. engine oil, brake fluid, cleaning solution, antifreeze, etc.) in the vehicle reach the maximum level, and adjust accordingly.

D.1.3.3 Confirm that the spare tires and on-board tools are in the corresponding positions of the vehicle, and remove any items in the vehicle that are not related to the vehicle.

D.1.4 Items to be checked and confirmed before test

D.1.4.1 Check and adjust the pressure of tires to the pressure specified by the vehicle manufacturer. The pressure of the left and right tires shall be the same so that the vehicle can be parked as horizontally as possible without tilting or other situations that may affect the light irradiation angle.

D.1.4.2 Confirm that the vehicle battery is fully charged, so as to ensure that the voltage during headlamp testing process remains basically stable and unaffected.

D.1.5 Counterweight

D.1.5.1 If the front seat is adjustable in the forward and backward directions, it shall be adjusted to the middle position of its adjustable stroke. If the seat is not locked in the middle position, it shall be adjusted to the first lockable position behind the middle position.

D.1.5.2 Place a 75 kg dummy or an equal mass counterweight at the driver's seat.

D.1.6 Vehicle soaking

Before the test, the vehicle shall be parked at the ambient temperature of 23±5°C for at least 8 hours.

D.1.7 Attaching C-NCAP mark and vehicle identification

The vehicle to be tested shall be pasted with the C-NCAP mark and the unique vehicle identification — the test number, as well as laboratory information.

D.2 HEADLAMP PARAMETER MEASURING

D.2.1 Measure the following parameters and record the values:

a) The installation height of the low beam or high beam optical axis of each headlamp

above the ground, as shown in Fig. D.1

b) The transverse position of the low beam or high beam optical axis of each headlamp from the median longitudinal plane of the vehicle, as shown in Fig. D.1.The median longitudinal plane is centred in between the wheel hubs of the vehicle and perpendicular to the test platform.

c) Initial alignment of low beam and high beam declared by vehicle manufacturer

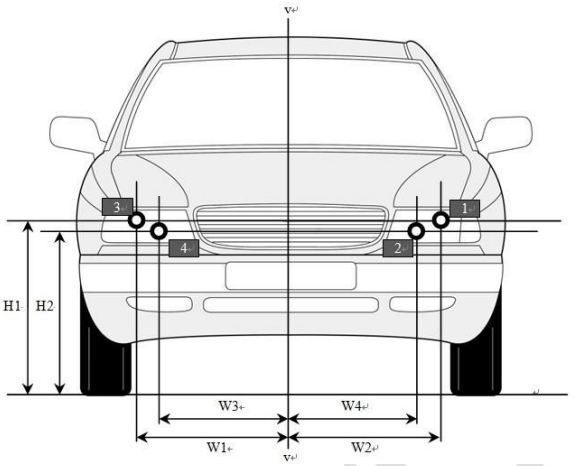

Fig. D.1 Measurement of Headlamp Basic Parameters

Legends:

1 Optical axis of the left low beam;

2 Optical axis of the left high beam;

3 Optical axis of the right low beam;

4 Optical axis of the right high beam;

V-V Vertical plane passing through the longitudinal axis of the vehicle;

H1 Height from the ground to the optical axis of the low beam;

H2 Height from the ground to the optical axis of the high beam;

W1, W2 Transverse position of the low beam optical axis from the median longitudinal plane of the vehicle (mm);

W3, W4 Transverse position of the high beam optical axis from the median longitudinal plane of the vehicle (mm).

D2.2 Turn on the low beam and high beam of the vehicle respectively. Record whether the high beam and low beam are integrated, whether the low beam is lit at the same time when the high beam is lit, and check and record the initial dip angle of the low beam of both headlamps.

D.3 TEST CONDITIONS

D.3.1 Test environment

D.3.1.1 The laboratory standard temperature is 23°C±2°C; the maximum relative humidity is 70%.

D.3.1.2 The equipment in the laboratory is sensitive to dust, and the test personnel shall be dedusted before entering and leaving the laboratory.

D.3.1.3 The illumination level in the dark laboratory shall be such that the photometer displays a value of less than 0.001 lx.

D.3.2 Requirements for test equipment

D.3.2.1 Test screen

D.3.2.2 The test screen shall be located 25 m from the null line origin of the lane.

D.3.2.3 Data acquisition equipment

D.3.2.4 Illuminance meter used in the test shall fulfill the following requirements, V(λ) match $< 1\%$ and the total characteristic $< 3\%$. In case additional photometric equipment like imaging luminance measurement device (ILMD) is used, it shall be corrected by the illuminance meter as above also.

D.3.2.5 The angular data acquisition range and precision of the goniophotometric measurement equipment shall be at least:

D.3.2.6 7D- 6U, in vertical direction;

D.3.2.7 60L -60R, in horizontal direction.

D.3.2.8 The angular data acquisition resolution shall be 0.01° with an absolute accuracy of less than ±0.05°.

D.3.2.9 The illuminance meter shall also be located in a nominal distance of 25 meters from the headlamp/null line of the lane when it is working.

D.3.2.10 The accuracy when determining the vehicle median longitudinal plane and front position shall be less than ±5mm.

D.3.3 Calibration

D.3.3.1 Angular calibration of the measurement system shall be carried out on a regular base as described in ILAC-G24:2007.

D.3.3.2 Photometric calibration of the illuminance meter shall be carried out on a regular base as described in ILAC-G24:2007.

D.3.3.3 In case an imaging luminance measurement device (ILMD) is used in combination with the test screen, it shall be calibrated against the illuminance meter desctribed in D.3.2.2, for instance by comparing the measured light distribution of a reference light source with the distribution recorded by the illuminance meter.

D.3.3.4 If there are any environmental changes, abnormalities or it is deemed necessary to carry

out calibration on the test site, calibration shall also be conducted.

D.4 TEST PROCEDURE

D.4.1 Test voltage acquisition

Start the vehicle to run the engine. Collect the terminal voltage at the terminal of the vehicle battery, and record the terminal voltage value as V0 when the terminal voltage is stable.

D.4.2 Vehicle attitude adjustment

D.4.2.1 Move the vehicle to the centre of the goniophotometric test platform.

D.4.2.2 The projection of the median longitudinal plane of the vehicle shall coincide with the road centre line and always keep that way in the testing process while the goniophotometric system is collecting the luminous intensity distributions. The headlamps of the vehicle are positioned at a distance of 25m to the screen.. The position of the vehicle on the test platform before and after the test shall be the same.

D.4.3 Test

D.4.3.1 After the vehicle engine off, parked still for five minutes, connect the external power supply to the positive and negative poles of the battery in parallel, and adjust the input voltage V1 of the external power supply to V1= V0.

D.4.3.2 Turn on the vehicle low beam. The left and right headlamps shall project clear cut- off lines on the light distribution screen. Check whether there are abnormal spots and abnormal streaks in the low beam light.

D.4.3.3 Cover the low beam headlamp on the right side of the vehicle.

D.4.3.4 The reference centre of the test screen shall be on the longitudinal plane at the same height as the reference centre of the low beam headlamp of the vehicle.

D.4.3.5 Alignment of low beam (instrument alignment method)

D.4.3.5.1 Vertical adjustment

Determine the initial downward orientation of the low beam, e.g. the position of Line B in Fig. D.2, as indicated on the vehicle close to the headlamp.

Use an illuminance meter to move upward from any point below Line B, as shown in Fig. D.2, and vertically scan through the horizontal portion of the cut-off line located 2.5° to the left of the V-V line. The scanning range is 2° up and down the specified point, and the scanning step length is not larger than 0.01°. Use formula 1 to determine the maximum gradient inflection point Gmax and position it on Line B in Fig. D.2

$$G=\log E_{\beta}-\log E_{(\beta+0.1°)}\text{.....}\quad \text{Formula 1}$$

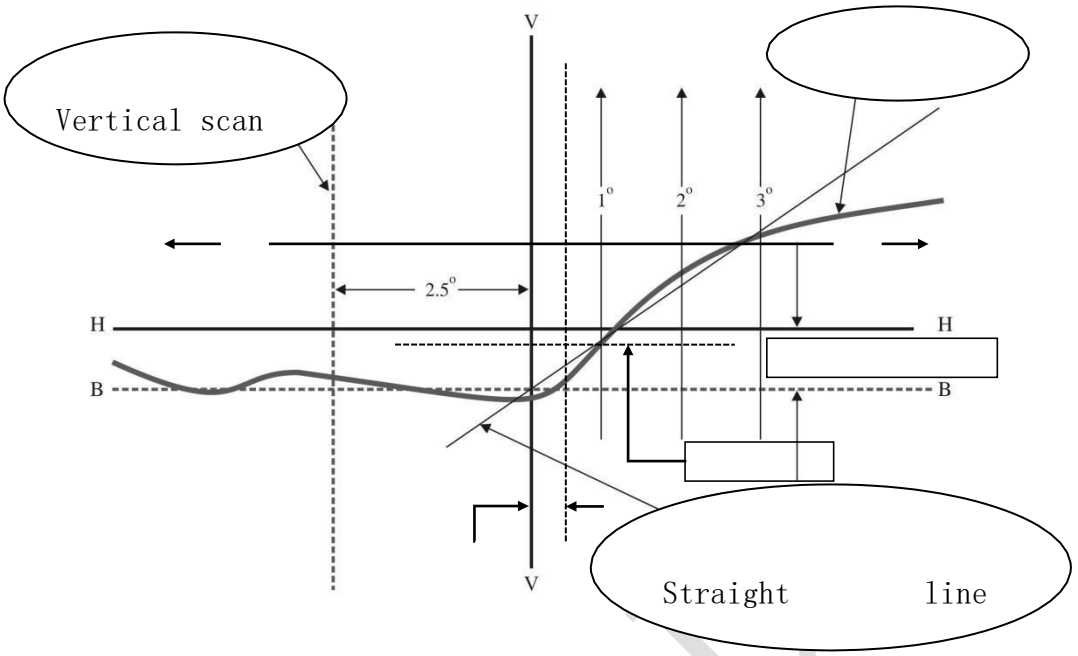

Fig. D.2 Instrument Alignment of Headlamp Low Beam

D.4.3.5.2 Horizontal adjustment

Horizontal adjustment method should be chosen from the following options. In case of doubt, refer to the manufacturer specification:

a) After the system is vertically aligned, scan at 0.2D horizontally from left 5° to right 5° Determine the maximum gradient Gmax by Formula 1, the inflection point which appears on 0.2D line, should be located on line A, e.g. for right-hand traffic at 0.5° on the right-hand side of V-V in Fig. D.2.

b) After the system is vertically aligned, scan from -2° to +2° on the 3 vertical lines 1°, 2° and 3° to the right side of the V -V line. Determine the maximum gradient Gmax on each line according to formula 1 to obtain the location points of the three maximum gradients Gmax,1R, Gmax,2R, Gmax,3R and use these 3 points for a straight-line regression. The intersection of the straight line and Line B in Fig.D.2 is taken as the inflection point of the cut-off line, and the inflection point shall be adjusted to the V-V line.

D.4.3.6 Alignment of high beam

Headlamps with independent adjusting devices for low and high beam must be adjusted separately, taking the intersection point between high beam lighting axis and testing screen (HV point) as reference centre. Otherwise, it shall be based on the reference centre from the low beam alignment, and once low beam was aligned, shall not make any further adjustment.

D.4.3.7 Headlamps using LED light sources need to be continuously lit before testing until a photometric steady state occurs (i.e. the photometric change rate of the low beam at 50V or the high beam HV points is less than 3% within any 15 min period) before the measurement is started.

D.4.3.8 The light distribution of low beam is collected with the illuminance meter. Alternatively, an ILMD may be used to obtain the low beam light distribution at the screen 25 m in front,

however, for the glare test area defined in Chapter III, the illuminance meter is used for testing. For low beam headlamps driven by PWM, the illuminance meter, driven in a slow mode supressing all effects of PWM, shall be used for all tests unless it can be demonstrated that the ILMD system delivers comparable results to the illuminance meter.Detection of PWM shall be done by using the illuminance meter in a fast response mode.

D.4.3.9 Remove the cover of the right low beam headlamp and cover the left low beam headlamp of the vehicle.

D.4.3.10 Repeat the test steps from D.4.3.4 to D.4.3.8 to complete the data acquisition of the right low beam headlamp.

D.4.3.11 Adjust the vehicle headlamp to the working state of the high beam, and cover the right high beam headlamp of the vehicle. The light distribution of the optical test screen is collected as described in D.4.3.8. For high beam headlamps driven by PWM, the illuminance meter as described in D.4.3.8 shall be used for all tests.

D.4.3.12 Remove the cover of the left high beam headlamp and cover the right high beam headlamp of the vehicle. Refer to the test step of D.4.3.11 to complete the data acquisition of the right high beam headlamp.

D.4.4 Data processing

D.4.4.1 The obtained screen light distribution of the left and right low beam lamps is converted into data taking into account the whole vehicle installation parameters of the low beam lamps, and converted into road illumination distribution after integration

D.4.4.2 Repeat the procedure of D.4.4.1 to obtain the road illuminance distribution of high beam lamps.

D.4.4.3 Based on the evaluation method in Chapter III of these rules, the corresponding index values are calculated.

D.4.4.4 Glare evaluation and high beam illumination range evaluation shall be conducted based on collected light distribution data.