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Motor vehicles — Measurement of variations in dipped-beam headlamp angle as a function of load

Automobiles — Mesurage des variations d'inclinaison du faisceau de croisement en fonction de la charge

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 4182, was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 8, *Lighting and signalling*.

This third edition cancels and replaces the second edition (ISO 4182:1986), which has been technically revised.

Annexes A to C form an integral part of this International Standard.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet iso@iso.ch

Printed in Switzerland

Motor vehicles — Measurement of variations in dipped-beam headlamp angle as a function of load

1 Scope

This International Standard specifies a method for measuring variations in the dipped-beam inclination of motor vehicle headlamps, in relation to the initial inclination, caused by changes in vehicle attitude due to loading. This measurement method may be used particularly during vehicle type approval tests.

Loading conditions of vehicles are specified in annex A. They are to be used except when legal regulations require different loading conditions.

Annex B establishes a classification of headlamps, and gives examples of measurement methods applicable according to the classification. Annex C gives a photometric method of determining the position of a point of the conventional cut-off, which is complementary to one of the measurement method examples in annex B.

This International Standard is applicable to motor vehicles as defined in ISO 3833.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 303:1986, *Road vehicles — Installation of lighting and light signalling devices for motor vehicles and their trailers*.

ISO 612:1978, *Road vehicles — Dimensions of motor vehicles and towed vehicles — Terms and definitions.*

ISO 3833:1977, *Road vehicles — Types — Terms and definitions.*

ISO 7227:1987, *Road vehicles — Lighting and light signalling devices — Vocabulary.*

EEC Directive 76/756, *Installation of lighting and light signalling devices on motor vehicles and trailers.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 612 and the following definitions apply.

3.1 Classification

3.1.1 vehicle, category M: Motor vehicle intended for transporting people.

3.1.2 vehicle, category M_1: Motor **vehicle, category M** (3.1.1), containing not more than eight seats, in addition to the driver's seat.

3.1.3 vehicle, category M_2: Motor **vehicle, category M** (3.1.1), containing more than eight seats, in addition to the driver's seat, and having a maximum permissible mass not exceeding 5 t.

3.1.4 vehicle, category M_3: Motor **vehicle, category M** (3.1.1), containing more than eight seats, in addition to the driver's seat, and having a maximum permissible mass exceeding 5 t.

3.1.5 vehicle, category N: Motor vehicle intended for transporting goods.

3.2 Initial inclination

3.2.1 stated initial inclination: Value of the dipped-beam initial inclination specified by the motor vehicle manufacturer, which serves as a reference value for the calculation of permissible variations.

3.2.2 measured initial inclination: Mean value of dipped-beam inclination or vehicle inclination measured with one person in the driver's seat for the category of vehicle under test, which serves as a reference value for the assessment of variations in beam inclination as the load varies.

3.3 Reference centre

Intersection of the reference axis with the light-emitting surface. [ISO 7227:1987, 3.41]

4 Type of vehicle

For the purposes of this International Standard, vehicles shall be considered to be of the same type if they do not differ in such essential respects as:

— wheel-base (wheel space) (as defined in ISO 612);

— location of headlamps on the motor vehicle;

— headlamp class (see annex B);

— characteristics of the suspension system;

— axle loads stated by the manufacturer;

— means used to correct dipped-beam angle according to load.

5 Dipped-beam inclination

The dipped-beam inclination is defined as follows:

— either as the angle, expressed in milliradians, between the direction of the beam towards a characteristic point on the horizontal part of the cut-off in the luminous distribution of the headlamp and the horizontal plane; or

— by the tangent of that angle, expressed in percentage inclination, since the angles are small (for these small angles, 1 % is equal to 10 mrad).

If the inclination is expressed in percentage inclination, it can be calculated by means of the following formula:

$$\frac{(h_1 - h_2)}{L} \times 100$$

where

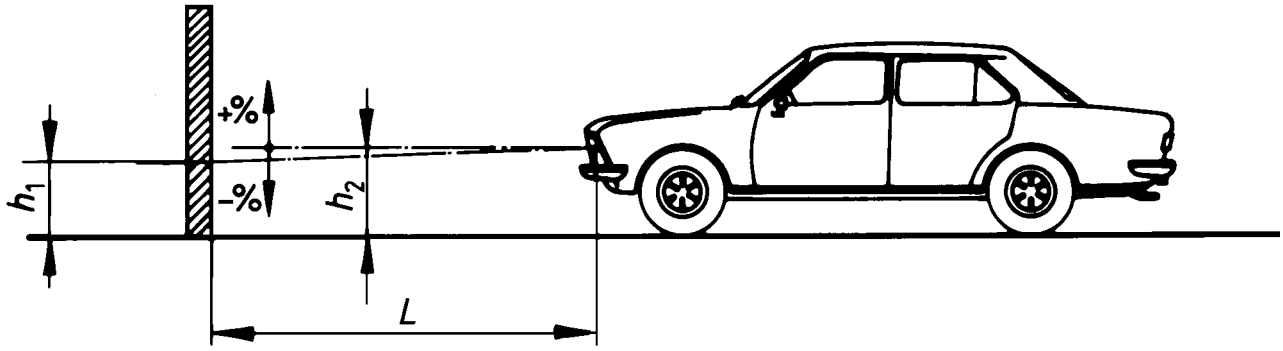
h_1 is the height above the ground, in millimetres, of a characteristic point in the luminous spread of the headlamp, measured on a vertical screen perpendicular to the vehicle longitudinal median plane, placed at a horizontal distance L;

h_2 is the height above the ground, in millimetres, of the centre of reference (which is taken to be the nominal origin of the characteristic point chosen in h_1);

L is the distance, in millimetres, from the screen to the centre of reference.

Negative values denote downward inclination (see figure 1).

Positive values denote upward inclination.



NOTES

1 This drawing represents a category M_1 vehicle, but the principle shown applies equally to vehicles of other categories.

2 Where the vehicle does not incorporate a headlamp levelling system, the variation in dipped-beam inclination is identical with the variation in the inclination of the vehicle itself.

Figure 1 — Dipped-beam downward inclination of a category M_1 vehicle

6 Measurement conditions

6.1 If a visual inspection of the dipped-beam pattern on the screen or a photometric method is used, measurements shall be carried out in a dark environment (for example, a dark room) of sufficient area to allow the vehicle and the screen to be placed as shown in figure 1. Headlamp centres of reference shall be at a distance from the screen of at least 10 m.

6.2 The ground on which measurements are made shall be as flat and horizontal as possible, so that the reproducibility of measurements of dipped-beam inclination can be assured with an accuracy of ± 0,5 mrad (± 0,05 % inclination).

6.3 If a screen is used, its marking, position and orientation in relation to the ground and to the median longitudinal plane of the vehicle, shall be such that the reproducibility of the measurement of the dipped-beam inclination can be assured with an accuracy of ± 0,5 mrad (± 0,05 % inclination).

6.4 During measurements, the ambient temperature shall be between 10 °C and 30 °C.

7 Vehicle preparation

7.1 Measurements shall be carried out on a vehicle which has travelled a distance of between 1 000 km and 10 000 km, preferably 5 000 km.

7.2 Tyres shall be inflated to the full-load pressure specified by the vehicle manufacturer. The vehicle shall be fully replenished (fuel, water, oil) and equipped with all the accessories and tools specified by the manufacturer.

NOTE — Full fuel replenishment means that the fuel tank is filled to not less than 90 % of its capacity.

7.3 The vehicle shall have the parking brake released and the gearbox in neutral.

7.4 The vehicle shall be conditioned for at least 8 h at the temperature specified in 6.4.

7.5 If a photometric or visual method is used, headlamps with a well-defined dipped-beam cut-off should preferably be installed on the vehicle under test in order to facilitate the measurements. Other means are allowed to obtain a more precise reading (for example, removal of the headlamp lens).

8 Test procedure

8.1 General

The variations in either dipped-beam or vehicle inclination, depending on the method chosen, shall be measured separately for each side of the vehicle. The results obtained from both left and right headlamps under all the load conditions specified in annex A, shall be within the limits set out in 8.5. The load shall be applied gradually without subjecting the vehicle to excessive shocks.

8.2 Determination of the measured initial inclination

8.2.1 The vehicle shall be prepared as specified in clause 7 and laden as specified in annex A (first loading condition of the respective vehicle category).

Before each measurement, the vehicle shall be rocked as specified in 8.4 below. Measurements shall be made three times.

8.2.2 If none of the three measured results differs by more than 2 mrad (0,2 % inclination) from the arithmetic mean of the results, that mean shall constitute the final result.

8.2.3 If any measurement differs from the arithmetic mean of the results by more than 2 mrad (0,2 % inclination), a further series of 10 measurements shall be made, the arithmetic mean of which shall constitute the final result.

8.3 Measurement methods

Any method may be used to measure variations of inclination provided that the readings are accurate to within ± 0,2 mrad (± 0,02 % inclination).

8.4 Treatment of vehicle in each loading condition

8.4.1 Activation of vehicle suspension

The vehicle suspension and any other part likely to affect dipped-beam inclination shall be activated according to the methods described in 8.4.2 to 8.4.4.

However, the test laboratories and manufacturers may jointly propose other methods (either experimental or based upon calculations), especially when the test poses particular problems, provided such calculations are clearly valid.

8.4.2 M_1 category vehicles with conventional suspension

With the vehicle standing on the measuring site and, if necessary, with the wheels resting on floating platforms (which shall be used if their absence would lead to restriction of the suspension movement likely to affect the results of measurements), rock the vehicle continuously for at least three complete cycles; for each cycle, first the rear and then the front end of the vehicle is pushed down.

The rocking sequence shall end with the completion of a cycle. Before making the measurements, the vehicle shall be allowed to come to rest spontaneously. Instead of using floating platforms, the same effect can be achieved by moving the vehicle backwards and forwards for at least a complete wheel revolution.

8.4.3 M_2, M_3 and N category vehicles with conventional suspension

8.4.3.1 If the treatment method for category M_1 vehicles described in 8.4.2 is not possible, the method described in 8.4.3.2 or 8.4.3.3 may be used.

8.4.3.2 With the vehicle standing on the measuring site and the wheels on the ground, rock the vehicle by temporarily varying the load.

8.4.3.3 With the vehicle standing on the measuring site and the wheels on the ground, activate the vehicle suspension and all other parts which may affect the dipped-beam inclination by using a vibration rig. This can be a vibrating platform on which the wheels rest.

8.4.4 Vehicles with non-conventional suspension

For vehicles with non-conventional suspension, where the engine has to be running, wait until the vehicle has assumed its final attitude with the engine running before making any measurements.

8.5 Measurements

8.5.1 The variation of the inclination of the dipped beam shall be assessed for each of the different loading conditions in relation to the measured initial inclination determined in accordance with 8.2 above.

If the vehicle is fitted with a manual headlamp-levelling system, the latter shall be adjusted to the positions specified by the manufacturer for given loading conditions (according to annex A).

8.5.2 To begin with, a single measurement shall be made in each loading condition. Requirements have been met if, for all the loading conditions, the variation in inclination is within the calculated limits (for example, within the difference between the stated initial inclination and the lower and upper limits specified for approval) with a safety margin of 4 mrad (0,4 % inclination).

8.5.3 If the result(s) of any measurement(s) does (do) not lie within the safety margin indicated in 8.5.2 or exceed(s) the limit values, a further three measurements shall be made in the loading conditions corresponding to this (these) result(s) as specified in 8.5.4.

8.5.4 For each of the above loading conditions:

8.5.4.1 If none of the three measured results differs by more than 2 mrad (0,2 % inclination) from the arithmetic mean of the results, that mean shall constitute the final result.

8.5.4.2 If any measurement differs from the arithmetic mean of the results by more than 2 mrad (0,2 % inclination), a further series of 10 measurements shall be made, the arithmetic mean of which shall constitute the final result.

8.5.4.3 If a vehicle is filled with an automatic headlamp-levelling system which has an inherent hysteresis loop, average results at the top and bottom of the hysteresis loop shall be taken as significant values. All these measurements shall be made in accordance with 8.5.4.1 and 8.5.4.2.

8.5.5 Requirements have been met if, under all loading conditions, the variation between the measured initial inclination determined in accordance with 8.2 and the inclination measured under each loading condition is less than the values calculated in 8.5.2 (without safety margin).

8.5.6 If only one of the calculated upper or lower limits of variation is exceeded, the manufacturer shall be permitted to choose a different value for the stated initial inclination, within the limits specified for approval.

Annex A
(normative)

Loading conditions for the different vehicle categories

A.1 General

For the following tests, the mass of the passengers shall be calculated on the basis of 75 kg per person.

A.2 Loading conditions for different types of vehicles

A.2.1 Category M_1 vehicles

The angle of the light beam of the dipped-beam headlamps shall be determined under the following load conditions.

A.2.1.1 Condition No.1

One person in the driver's seat.

A.2.1.2 Condition No.2

The driver, plus one passenger in the front seat furthest from the driver.

A.2.1.3 Condition No.3

The driver, one passenger in the front seat furthest from the driver, all the seats furthest to the rear occupied.

A.2.1.4 Condition No.4

All the seats occupied.

A.2.1.5 Condition No.5

All the seats occupied, plus an evenly distributed load in the luggage boot, in order to obtain the permissible load on the rear axle or on the front axle if the boot is at the front. If the vehicle has a front and rear boot, the additional load must be appropriately distributed in order to obtain the permissible axle loads. However, if the maximum permissible laden mass is obtained before the permissible load on one of the axles, the loading of the boot(s) shall be limited to the figure which enables that mass to be reached.

A.2.1.6 Condition No.6

The driver, plus an evenly distributed load in the boot, in order to obtain the permissible load on the corresponding axle.

However, if the maximum permissible laden mass is obtained before the permissible load on the axle, the loading of the boot(s) shall be limited to the figure which enables that mass to be reached.

NOTE — In determining the above loading conditions, account must be taken of any loading restrictions laid down by the manufacturer.