International Standard 4182

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Road vehicles — Motor vehicles — Measurement of variation of passing beam inclination as a function of load

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

First edition — 1979-09-01

UDC 629.113.06 : 628.94 **Ref. No. ISO 4182-1979 (E)**

Descriptors : road vehicles, motor vehicles, vehicle lighting, stability, measurement, loads (forces).

Price based on 8 pages

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4182 was developed by Technical Committee ISO/TC 22, *Road vehicles*, and was circulated to the member bodies in May 1978.

It has been approved by the member bodies of the following countries :

Australia	Japan	Spain
Austria	Korea, Dem. P. Rep. of	Sweden
Belgium	Korea, Rep. of	Switzerland
Brazil	Mexico	Turkey
Chile	New Zealand	United Kingdom
France	Philippines	USSR
Germany, F. R.	Poland	Yugoslavia
Iran	Romania	
Italy	South Africa, Rep. of	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Bulgaria
Czechoslovakia
Netherlands
USA

Printed in Switzerland

Road vehicles — Motor vehicles — Measurement of variation of passing beam inclination as a function of load

1 Scope

This International Standard specifies a method of measurement of variations of motor vehicle passing beam inclination, with respect to its initial inclination, caused by the changes in vehicle attitude due to loading. This method of measurement may particularly be used during vehicle type approval tests.

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

2 Field of application

This International Standard applies to motor vehicles as defined in ISO 3833, item 3.1.

3 References

ISO/R 303, *Lighting and signalling for motor vehicles and trailers.*[1)]

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

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

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

4 Definitions

4.1 Classification

For the purpose of this International Standard, vehicles defined in ISO 3833 are classified as follows :

4.1.1 vehicle, category M : A motor vehicle intended for the carriage of passengers.

4.1.1.1 vehicle, category M_1 : A motor vehicle, category M (4.1.1), containing not more than eight seats, in addition to the driver's seat.

4.1.1.2 vehicle, category M_2 : A motor vehicle, category M (4.1.1), containing more than eight seats, in addition to the driver's seat, and having a maximum permissible mass not exceeding 5 tonnes.

4.1.1.3 vehicle, category M_3 : A motor vehicle, category M (4.1.1), containing more than eight seats, in addition to the driver's seat, and having a maximum permissible mass exceeding 5 tonnes.

4.1.2 vehicle, category N : A motor vehicle intended for the carriage of goods.

4.2 Type of vehicle

For the purpose 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 space (ISO 612, No. 6.4);
- location of the headlamps on the motor vehicle;
- headlamp class (see annex B);
- characteristics of the suspension system;
- axle loads stated by the manufacturer;
- means used for correcting passing beam inclination according to load.

4.3 Initial inclination

4.3.1 stated initial inclination : The value of the passing beam initial inclination specified by the motor vehicle manufacturer.

It serves as a reference value for the calculation of permissible variation.

1) At present in the course of revision.

4.3.2 measured initial inclination : The mean value of passing beam inclination or vehicle inclination measured with the vehicle in condition No. 1 as defined in annex A for the category of vehicle under test.

It serves as a reference value for the assessment of variation in beam inclination as the load varies.

4.4 passing beam inclination : The inclination may be defined :

— either as the angle, expressed in milliradians, between the direction of a characteristic point in the luminous distribution of the headlamp and the horizontal plane;

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

If the inclination is expressed in percent inclination, it can be calculated by 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 distribution 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, in millimetres, of the centre of reference (4.5) above the ground;

l is the distance, in millimetres, from the screen to the centre of reference (4.5).

Negative values denote downward inclination (see figure 1). Positive values denote upward inclination.

4.5 centre of reference : The centre of reference is indicated by the headlamp manufacturer.

5 Measurement conditions

5.1 If visual inspection of the passing beam pattern on the screen, or a photometric method, is used, measurements shall be carried out in a dim environment (for example a dark room) of sufficient area to allow the vehicle and screen to be placed as shown in figure 1.

Headlamp centres of reference (4.5) shall be at a distance l from the screen of at least 10 m.

5.2 Vehicle and screen shall be located in such a way that the following requirements are met :

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

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

5.3 During measurements, the ambient temperature shall be within 10 to 30 °C.

6 Vehicle preparation

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

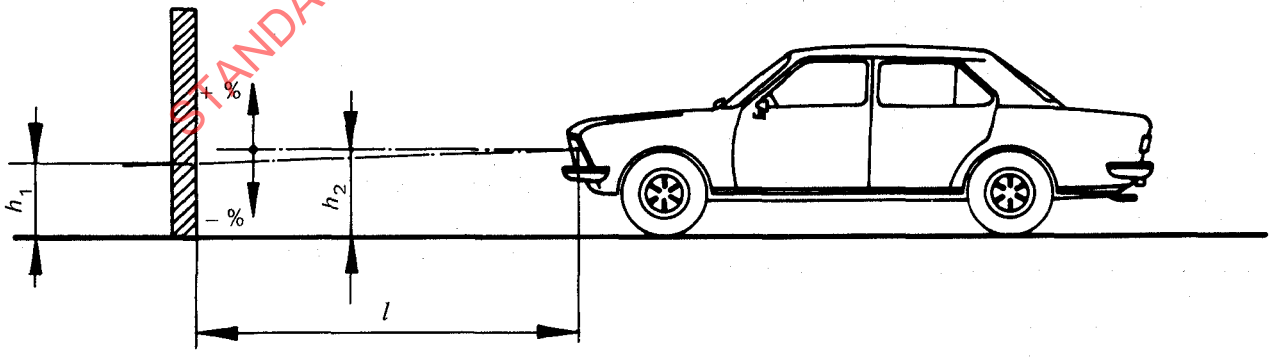

Figure 1 — Passing beam downward inclination for a passenger car

NOTES

1 This drawing represents a passenger car category M_1 but the principle shown applies equally to a vehicle of another category.

2 Where the vehicle does not incorporate a headlamp-levelling device, the variation of the passing beam inclination is identical with the variation of the inclination of the vehicle itself and can be derived from this (see annex B).

6.2 Tyres shall be inflated to the full-load pressure specified by the 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 must be filled to not less than 90 % of its capacity.

6.3 The vehicle shall have the parking brake released and the gear box in neutral.

6.4 The vehicle shall be conditioned for at least 8 h at the temperature specified in 5.3.

6.5 If a photometric or visual method is used, and if the vehicle is equipped with cut-off type headlamps, then in order to facilitate the measurements, headlamps with a well defined passing beam cut-off should preferably be chosen and installed on the vehicle under test.

For special preparations see annex B.

When so agreed between the vehicle manufacturer and the test laboratory, other means are allowed to obtain a more precise reading (for example removal of headlamp lens).

7 Test procedure

7.1 General

The variations of the passing beam inclination or the variations of the vehicle inclination, according to the method chosen, shall be measured separately for each side of the vehicle. The results obtained on both left and right headlamps, in all load conditions specified in annex A, shall be within the limits set in 7.5. The load shall be applied gradually, without subjecting the vehicle to excessive shocks.

7.2 Determination of the measured initial inclination

The vehicle shall be in the conditions specified in clause 6 and laden as specified in annex A (first paragraph of the respective vehicle category).

Before each measurement, the vehicle shall be rocked as specified in 7.4.

Measurements shall be made three times.

7.2.1 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.

7.2.2 If, for any measurement, this difference is greater than 2 mrad (0,2 % inclination) from the arithmetic mean of the results, a further series of 10 measurements shall be made.

The arithmetic mean of these ten new measurements shall constitute the final result.

7.3 Measurement methods

Depending on the headlamp class as defined in annex B, various measurement methods are applicable, provided that the readings are within an accuracy of ± 0,2 mrad (± 0,02 % inclination).

Examples of test methods are given in annex B; other alternative methods are allowed provided that they give equivalent results.

7.4 Treatment of vehicle after load variation

After each load variation, the vehicle suspension and any other part likely to affect passing beam inclination shall be activated, according to the methods described below.

However, in agreement with the test laboratories, manufacturers may propose other methods (either experimental or based upon calculations), especially when experiment presents special difficulties and when such calculations are clearly valid.

7.4.1 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[1] (which may be used only if their absence would lead to restriction of the suspension movement likely to influence the results of measurements), rock the body longitudinally as follows :

— Rock the vehicle continuously for at least three complete cycles, each cycle consisting in pushing down first the rear end and then the front end of the vehicle.

The rocking sequence shall end with the completion of a cycle. Before taking the measurements, wait until the vehicle comes to rest spontaneously.

7.4.2 M_2, M_3 and N category vehicles with conventional suspension

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

1) Obtained by placing metal balls between the bottom plate on the ground and the top plate supporting the wheels.

7.4.3 Vehicles with non-conventional suspension, requiring the functioning of the engine (for example hydraulic or pneumatic)

Apply the following procedure, modified, if necessary, according to the manufacturer's specifications :

a) Adjust the engine speed to meet the manufacturers specifications.

b) If necessary, provide additional means for engine cooling.

c) After each change in loading, before taking any measurement wait, if necessary, until the vehicle has resumed a stabilized attitude.

d) Since tests are conducted in the laboratory, make sure that the air pipe to the atmosphere from the exhaust pipe does not impede movement of the vehicle or taking of measurements.

7.5 Measurements

The variation in the inclination of the passing beam shall be assessed for each of the different load conditions in relation to the measured initial inclination determined in accordance with 7.2. When the vehicle is equipped with a manual headlamp-levelling system, the latter shall be adjusted to the positions specified by the manufacturer for given load conditions.

7.5.1 In the first instance, a single measurement shall be made in each loading condition. 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), compliance is assured.

7.5.2 If the result(s) of any measurement(s) does (do) not respect the safety margin indicated in 7.5.1 or exceed(s) the limit values, a further three measurements shall be taken in the loading conditions corresponding to this (these) result(s), as specified in 7.5.3.

7.5.3 For each of the above loading conditions :

a) 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.

b) If, for any measurement, this difference is greater than 2 mrad (0,2 % inclination) from the arithmetic mean of the results, a further series of 10 measurements shall be taken, the arithmetic mean of which shall constitute the final result.

c) In the case of a vehicle equipped with an automatic headlamp-correcting 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 taken according to the above paragraphs 7.5.3 a) and 7.5.3 b).

7.5.4 If, under all load conditions, the variation so obtained between the measured initial inclination determined in accordance with 7.2 and the inclination measured under each load condition is less than the values calculated in 7.5.1 (without safety margin), compliance is assured.

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

Annex A

Loading conditions for the different vehicle categories

A.1 General

For the purpose of the tests described below, each of the seats (fixed, foldable or removable) to be considered in the various conditions of loading shall be loaded with a mass of 75 kg simulating the passenger and his hand luggage.

A.2 Loading conditions

Variations of passing beam inclination caused by the changes in vehicle attitude due to loading shall be measured under the following load conditions.

A.3 M_1 category vehicles

A.3.1 Condition No. 1

One occupant on the driver's seat.

A.3.2 Condition No. 2

Driver, plus one occupant on the front seat farthest from the driver's seat.

A.3.3 Condition No. 3

Driver, plus one occupant on the front seat farthest from the driver's seat, plus occupants on all the rearmost seats.

A.3.4 Condition No. 4

Occupants in all seating positions.

A.3.5 Condition No. 5

Occupants in all seating positions, plus balanced loading of luggage compartment (or of station wagon load deck) so as to obtain the maximum permissible load on rear or front axle, depending on whether the compartment is at the rear or the front.

Should the vehicle be equipped with one front and one rear luggage compartment, the additional load shall be uniformly distributed so that the maximum axle load requirements are met; however, if the total maximum permissible load is attained before the maximum permissible load on one of the two axles is attained, then the loading of the luggage compartment(s) shall be limited to the value permitting the attainment of the said total load.

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

A.4 M_2 and M_3 category vehicles

A.4.1 Condition No. 1

One occupant on the driver's seat.

A.4.2 Condition No. 2

Occupants in all seating positions and additional load located over the rear axle until that axle supports its maximum permissible load, or until the maximum permissible mass of the vehicle is attained, whichever occurs first.

NOTE — If the vehicle has a separate load compartment or load area, the additional load is to be uniformly distributed over that compartment/area.

A.5 N category vehicles with load platform

A.5.1 Condition No. 1

One occupant on the driver's seat.

A.5.2 Condition No. 2

Driver, plus a load so distributed as to give the maximum technically permissible load on the rear axle or axles, or the maximum permissible mass of the vehicle, whichever occurs first, without exceeding a front axle load calculated as the sum of the front axle load of the unladen vehicle plus 25 % of the maximum permissible payload on the front axle. Conversely, the front axle is considered when the load platform is at the front.

A.6 N category vehicle without load platform

A.6.1 Truck tractors for semi-trailers

A.6.1.1 Condition No. 1

One occupant on the driver's seat, with no load on the fifth wheel.

A.6.1.2 Condition No. 2

Driver, plus the maximum technically permissible load on the fifth wheel, in the fifth wheel location corresponding to the maximum load on the rear axle.

A.6.2 Trailer tractors

A.6.2.1 Condition No. 1

One occupant on the driver's seat.

A.6.2.2 Condition No. 2

Driver, plus occupants in all the other seating positions in the cab.

Annex B

Methods of measurement

B.0 Introduction

Examples are given in clause B.2 of different methods for assessing the magnitude of variations in passing beam inclination. However, some of these methods are not applicable to vehicles equipped with certain types of headlamp installation. For the purposes of this annex, therefore, headlamps are considered to belong to one of three classes, as defined in clause B.1; applicable methods of measurement are indicated for each class of headlamp.

B.1 Headlamp classification — Applicable methods

B.1.1 Class I

Headlamps which are fixed rigidly to the vehicle frame or bodywork, and in which the optical elements do not move to compensate for changes in vehicle loading.

NOTE — Semi-fixed aiming devices (for initial aim setting) and mechanisms for headlamp concealment are both considered as rigidly fixed.

Applicable methods : B.2.1 a) or B.2.1 b)
B.2.2 a) or B.2.2 b)
B.2.3 a) or B.2.3 b)

B.1.2 Class II

Headlamps which are re-settable (manually or automatically) with respect to the vehicle frame or bodywork as a function of variations in vehicle loading.

Applicable methods : B.2.1 a) or B.2.1 b)
B.2.2 a) or B.2.2 b)

B.1.3 Class III

Headlamps in which the lens is rigidly fixed to the vehicle frame or bodywork, but in which the reflector or other optical elements are re-settable (manually or automatically) as a function of variations in vehicle loading.

Applicable methods : B.2.1 a) or B.2.1 b)

B.2 Methods of measurement

NOTE — The examples given below are not intended to provide a comprehensive list : other suitable methods may be used with the agreement of the test laboratory.

B.2.1 Direct measurement of passing beam inclination

The passing beam shall be projected on to a screen. The distance *l* from the screen to the reference centre of the headlamp shall be not less than 10 m. All measurements of inclination and its variation shall be taken from a chosen characteristic point in the passing beam pattern. The lens may be masked partially to increase the sharpness of the beam pattern on the screen. If the passing beam pattern has a well-defined horizontal cut-off, a characteristic point shall be chosen which is on a suitably central part of the horizontal cut-off line. For European-type headlamps, this part of the horizontal cut-off is contained between two vertical lines traced on the screen, passing through the points HV and B50 L (or B50 R, as appropriate).

Method a) — Direct measurement, by visual inspection of the chosen characteristic point

Variations in the height above the ground of the characteristic point may be measured directly, for example by reference to suitable graduations marked on the screen.

Method b) — Measurement by photometric means

The position of the characteristic point, and the variations in its height above the ground, may be determined by a photometric method such as that described in annex C. In this case, the electrical supply to the headlamps shall be stabilized.

B.2.2 Measurement of headlamp orientation in the vertical plane

Method a) — Laser and mirror

A plane mirror, of good optical quality and with the reflective coating on its exposed surface, shall be mounted in the centre of the headlamp lens. Use of a helium-neon (He-Ne) laser is recommended. The distances from the laser to the mirror and from the mirror to the measuring point shall be greater than 3 m. Unless the optical layout is so arranged that both the incident and the reflected rays are substantially horizontal, a correction will be necessary to compensate for vertical displacements of the headlamp due to changes in vehicle loading.

Method b) — Inclinometer

A suitable inclinometer, which may be one of the following types, shall be connected directly to the headlamp :

— electronic;

— bubble level, with vernier.

B.2.3 Measurement of vehicle attitude

Method a) — Direct measurement of vehicle height

Two reference points shall be chosen, on the same side of the vehicle. The horizontal distance between the two points shall be at least 70 % of the vehicle overall length.

Both points shall lie in a horizontal plane at a height above the ground of between 80 and 120 % of the height above the ground of the headlamp reference centre.

Method b) — Inclinometer

The inclinometer shall be attached securely to a suitably rigid part of the vehicle frame or bodywork.