INTERNATIONAL STANDARD

ISO 10604

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Road vehicles — Measurement equipment for orientation of headlamp luminous beams

Véhicules routiers — Équipement de mesure de l'orientation des faisceaux lumineux émis par les projecteurs

Reference number
ISO 10604:1993(E)

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 10604 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Sub-Committee SC 8, *Lighting and signalling*.

Annex A of this International Standard is for information only.

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Road vehicles — Measurement equipment for orientation of headlamp luminous beams

1 Scope

This International Standard specifies the dimensional, mechanical and optical quality criteria for equipment to measure or to verify the orientation of the luminous beams emitted by the headlamps installed on road motor vehicles excluding mopeds and motorcycles.

The equipment also allows evaluation of the quality of the luminous beams by visual means. Quality criteria for photometric devices are given in clause 12, and enable a more objective evaluation to be carried out.

This International Standard lays down the requirements for

a) the floor on which the vehicles are placed;

b) the vehicle preparation;

c) equipment using a distant screen;

d) optical equipment with installation and operating instructions;

e) photometric devices (see clause 12).

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was 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 edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1176:1990, *Road vehicles — Masses — Vocabulary and codes.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 test area floor: Delimited area on which the vehicles are placed to measure or to verify the orientation of the luminous beams emitted by their headlamps.

3.2 reference plane: Plane characterizing the test area floor.

3.3 vehicle direction: Direction parallel to the reference plane and to the median longitudinal plane of the vehicle standing on the test area floor.

3.4 headlamp: Lighting device able to emit at least a main beam, a dipped beam or a front fog beam but with a single aiming even if different beams can be emitted.

3.5 beam axis: Reference axis according to beam pattern requirements.

NOTE 1 In the case of reciprocally incorporated lamps, the beam axes of the beams emitted by the same headlamp may be different.

3.6 aiming screen: Screen on which the headlamp beam pattern can be observed.

3.7 optical block: Device focussing the headlamp beam on an aiming screen and allowing a vertical displacement of the aiming screen or of the beam image, calibrated on an inclination scale.

3.8 optical apparatus: Optical block mounted on a frame allowing positioning and alignment of the optical block in front of the headlamp.

3.9 screen reference point: Intersecting point on the aiming screen of a light ray parallel to the vehicle direction originating from the lens centre of the headlamp under test, in the reference position in the case of an optical apparatus.

3.10 reference position of optical apparatus: Position of the optical block and of the inclination scale so that the reference point on the aiming screen represents the vehicle direction.

3.11 inclination: Tangent, expressed in per cent of the up- or downward angle with regard to the vehicle direction.[1)]

3.12 lateral deviation: Tangent, expressed in per cent of the lateral angle with regard to the vehicle direction.[1)]

4 Test area floor

4.1 The test area floor is composed of two rolling tracks which are clearly indicated on the floor.

In the case of use for symmetrical three-wheeled vehicles, the test area floor will need a central rolling track for the third wheel.

4.2 The rolling track minimum dimensions shall be as follows (see figure 1):

a) maximum distance between the tracks 0,9 m

b) minimum overall width:
   — for passenger cars 2 m
   — for any motor vehicle 2,3 m

c) minimum length
   — for passenger cars 4 m
   — for any motor vehicle 8,5 m

However, in the case of equipment intended exclusively for checking one type or certain types of defined vehicles, the dimensions of the rolling tracks may be limited to the useful zones for this type(s) of vehicle.

4.3 The rolling tracks shall be sufficiently level in order not to deviate from the reference plane[2)] by more than the following tolerances (see figure 2):

— over a length of 2 m, the floor may not be lower than 4 mm under the reference plane,

— beyond 2 m, the floor has to be situated between two limiting planes opening out in the form of a wedge with gradients of 2 mm/m.

The slope of the reference plane (longitudinally as well as laterally) may not exceed 1 %.

4.4 The rigidity of the rolling tracks shall be sufficient to ensure that they stay within the tolerances when the heaviest vehicles are placed on the test area floor.

Dimensions in metres

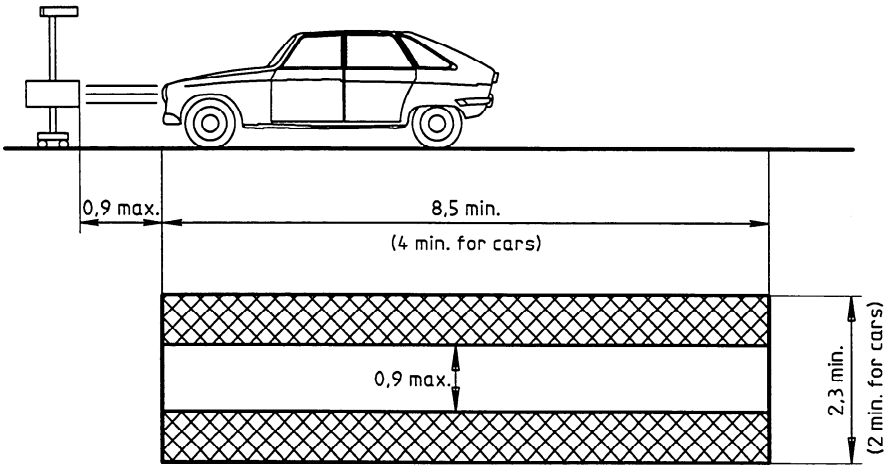

Figure 1 — Test area floor dimensions

1) Inclinations and lateral deviations of light rays emitted by a headlamp can be measured directly on the aiming screen with regard to the reference point: for example, at 10 m in front of the headlamp, 1 % corresponds to a distance of 0,1 m on the screen.

2) The reference plane can, for example, be made of straight sections of 2 m placed on the first part of the rolling tracks and adjusted to have the same slope. The tolerance of 4 mm can thus be checked easily by 4 mm gauges.

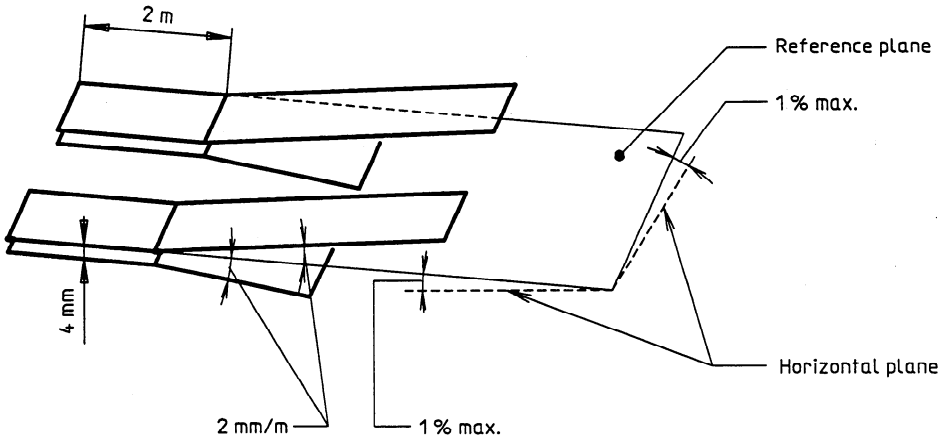

Figure 2 — Test area floor tolerances

5 Vehicle preparation

5.1 Unload the vehicle and fill the fuel tank to attain the complete vehicle kerb mass as specified in ISO 1176.

Except for semi-trailers, disconnect any trailer.

Remove any excessive accumulation of mud, snow or ice which could affect the vehicle attitude.

Check that the headlamps are clean and dry.

Seat a driver of approximately 75 kg on the driver's seat.

Check the tyres and inflate them to the pressure prescribed by the vehicle manufacturer for normal driving conditions on the road.

For vehicles in public or commercial use that have cargo that is generally located in the vehicle when driven, the vehicle should be left with this cargo in its normal location in the vehicle.

5.2 Bring vehicles with pneumatic suspension and seat corrector to the normal road position.

Set any levelling device to the "0"-position.

Drive the vehicle on to the test area floor and bring it gently to a halt on the headlamp checking point with the steering in the straight ahead position.

6 Distant aiming screen

6.1 A wall or panel approximately perpendicular, within ± 5°, to the rolling tracks may be used as an aiming screen, provided that it satisfies the following conditions.

a) The reflectivity shall be sufficient and the ambient lighting low enough to be able to observe the luminous beams on the screen clearly.

b) The distance in front of the headlamp shall be at least 7,5 m, the most practical distance being 10 m because a 1 % inclination then corresponds to 0,1 m on the screen.

c) The screen height shall be at least 1,5 m and its width at least 3 m for a fixed screen at 10 m; movable screens can be smaller but at least 0,6 m by 1,8 m.

6.2 Clearly indicate either the intersection with the reference plane or a line parallel to it with the indication of its height above the reference plane on the aiming screen (see figure 3).

6.3 For each vehicle placed on the test area floor, draw the intersection with the median longitudinal plane on the aiming screen.

The marking of the median longitudinal plane on the aiming screen can be done by indicating the intersecting points of two symmetrical axes of vision and by drawing this line in the middle between them. It is necessary to check whether the references on the vehicle body used for the vision are still symmetrical and have not moved as a result of collisions or repairs. If the references are based on the wheels, these shall be equipped with tyres of the same make and type, and the same degree of wear per axle.

6.4 Draw two vertical lines symmetrically on the screen, the distance between them being equal to the distance between the lens centres of the headlamps to be measured.

The heights of the lens centres above the reference plane marked on these vertical lines above the reference plane indicate the screen reference points.

6.5 Draw the characteristic lines of the beam patterns to be verified or measured with reference to these reference points, taking into account the inclination prescriptions for these luminous beams.

6.6 If a movable screen is used, follow a similar procedure in order to align the reference point in the correct position for each headlamp.

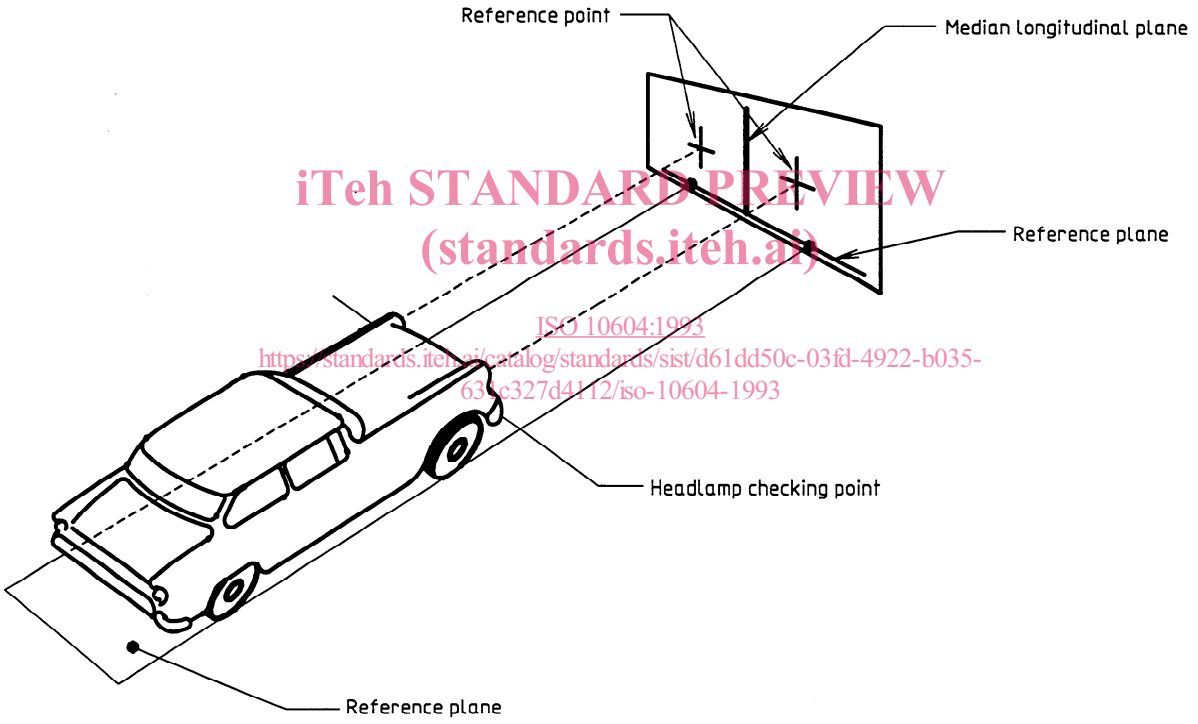

Figure 3 — Alignment on distant aiming screen

7 Optical apparatus

7.1 The apparatus shall be of robust construction and the materials used shall withstand wear and corrosion to ensure that correct functioning is not impaired.

7.2 The apparatus shall be easy to handle.

7.3 An alignment device shall enable the optical block to be oriented laterally to the median longitudinal plane of a vehicle.

This alignment may be possible either

a) on the vehicle body; or

b) on the vehicle wheels.

7.4 A centring aid shall allow the optical block to be centred easily in front of the headlamps.

7.5 Vertical displacement of the optical block with a simple, strong device shall be possible, to allow the measurement of headlamps situated between 0,25 m and 1,2 m above the reference plane. This condition is considered to be met if the optical centre can be positioned between 0,275 m and 1,175 m above the reference plane.

However, in the case of equipment intended exclusively for checking one type or certain types of defined vehicles, the upward stroke of the optical block may be limited to the useful zones for this type(s) of vehicle.

7.6 During this vertical displacement, the change in the alignment of the optical block in relation to that at 0,75 m above the reference plane shall not deviate by more than 0,2 % in inclination and 0,3 % laterally.

7.7 The apparatus shall be provided with the necessary adjusting devices to compensate for the effect of any wear on the inclination. It shall be impossible to change this adjustment without tools.

8 Optical block

8.1 The diaphragm of the optics shall be larger than an area delimited by a circle 220 mm in diameter and two horizontal lines 120 mm apart, symmetrical to the circle centre.

8.2 The aiming screen shall have indications of the reference point and the characteristic lines of the beam patterns necessary for aiming. These characteristic lines are positioned with regard to the beam axis which is represented by the reference point.

8.3 Relative vertical displacement of the beam images on the screen shall be possible at least for beam axis inclinations between 0,5 % upwards and 2 % downwards. Calibration on an inclination scale allowing a reading to the nearest 0,1 % shall be possible.

8.4 The reference position of the inclination scale shall correspond either

a) to the zero of the scale (the scale thus indicating the beam axis aiming inclinations), or

b) to the value 1 % downwards on the scale (the scale thus indicating the aiming inclinations for the cut-off of European dipped beams).

8.5 The zero of the inclination scale shall be adjustable. It shall be impossible to change this adjustment without tools.

8.6 The optical block shall be provided with a device which indicates any error in its vertical alignment exceeding 0,2 %. This device shall be adjusted during the installation of the apparatus according to the longitudinal slope of the reference plane, after which it is sealed.

9 Test apparatus

9.1 The apparatus for the tests comprises the following.

9.1.1 Slab, horizontal to less than the nearest 0,02 %, to be used as a support for the optical apparatus.

9.1.2 Projection equipment, whose lens centre is situated 0,75 m above the slab and 0,8 m from the optics of the optical apparatus: this equipment can project, through its lens diaphragm 15 mm in diameter, a grid of orthogonal straight lines equidistant by values corresponding to 1 % — its axis, representing the vehicle direction, being projected horizontally to less than the nearest 0,02 %.

9.1.3 Horizontal straight line, at the vertical of the projection equipment lens approximately at the same height on the slab and perpendicular to the axis of the projected grid.

9.2 Install the apparatus to be tested, calibrated for a horizontal reference plane, on the slab (9.1.1) according to the manufacturer's instructions so that its optic is 0,8 m in front of the projection equipment lens (9.1.2). Centre the optical block on the projection equipment and align laterally on the perpendicular straight line (9.1.3) with the aid of the apparatus alignment device.

9.3 Set the projection equipment to obtain an image which is as clear as possible in the axis of the projected grid on the apparatus screen. This adjustment shall correspond to focussing at a distance of at least 10 m.

9.4 The image on the apparatus screen shall at least include a central rectangle delimited by deviations of 9 % to left and right and inclinations 3 % above and below the grid axis. In natural daylight without direct sunlight, the haze of the grid lines over the whole of this area shall be limited so that an inclination variation of 0,1 % of the image on the screen is easy to perceive.

9.5 The alignment accuracy of the grid axis with regard to the reference point on the apparatus screen shall be such that:

a) the error in lateral deviation does not exceed 0,3 %,

b) the error in inclination does not exceed 0,2 % over the inclination scale interval between 0,5 % upwards and 2 % downwards from the reference position.

9.6 The quality of the image in the central rectangle delimited by deviations of 7 % to left and right and by inclinations 3 % above and below the grid axis shall be such that:

a) the haze of the grid lines is negligible;

b) the curvature of the sides of this rectangle is limited, in accordance with the indications in figure 4, to:

$$\alpha \leqslant 0{,}2\,\frac{A}{7}$$

$$\beta \leqslant 0{,}2\,\frac{B}{3}$$

c) the equidistance errors between the projected grid lines are limited so that in accordance with the indications in figure 4:

$$6{,}8 \leqslant \frac{A}{b} \leqslant 7{,}2$$

$$2{,}9 \leqslant \frac{B}{a} \leqslant 3{,}1$$

9.7 The errors of the characteristic position lines on the screen shall not exceed 0,1 % lateral deviation or inclination.

10 Apparatus installation

10.1 The apparatus platform or suspension shall allow the optical block to be placed in front of all the headlamps of any road vehicle placed on the test area floor in such a way that its optics are not further than 0,9 m from the test area floor as shown in figure 1.

10.2 This platform or suspension shall be such that during the displacement of the apparatus, the vertical alignment of the optical block does not vary by more than 0,2 % inclination from its mean value over the whole useful zone 2 m or 2,3 m wide (see 10.4).

10.3 In the case of transverse guiding of the apparatus, allowing lateral alignment by one single operation for all the headlamps of a vehicle, the alteration of this lateral alignment shall not exceed 0,3 % deviation over the whole useful zone 2 m or 2,3 m wide (see 10.4).

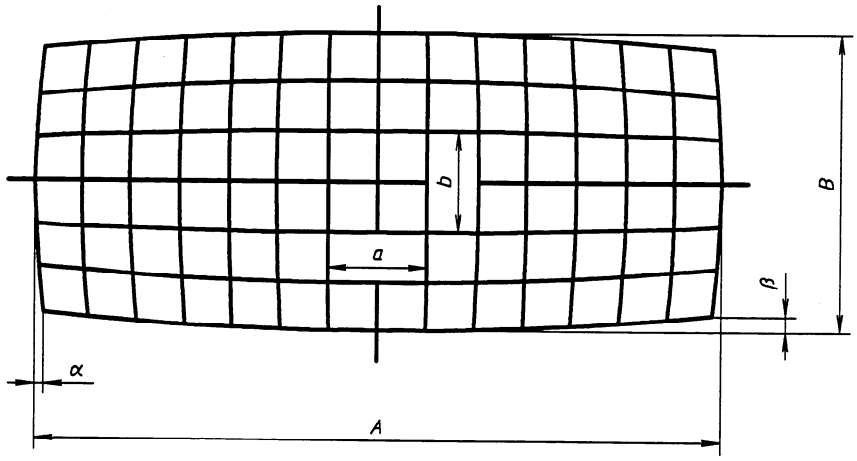

Figure 4 — Grid deformation

10.4 However, in the case of equipment intended exclusively for checking one type or certain types of defined vehicles, the range of horizontal movement of the apparatus given in 10.2 and 10.3 may be limited to the useful zones for this type(s) of vehicle.

11 Installation and operating instructions for apparatus

11.1 Each unit of apparatus shall be accompanied by a technical booklet which gives the installation and operating instructions.

11.2 The installation instructions shall include at least the text of clause 4 with figures 1 and 2 and the conditions, in order to satisfy the requirements of 7.6, 10.2 and 10.3.

11.3 The operating instructions shall also include at least the text of clause 5 and the conditions, in order to satisfy the requirements of 9.5 a):

a) in the case of 7.3 a), even if the vehicle body is inclined laterally by more than 1 %;

b) in the case of 7.3 b), even if the vehicle wheels are offset by more than 3 mm in the longitudinal sense.

11.4 The operating instructions shall further indicate the significance of the markings on the inclination scale and the aiming screen.

11.5 If the apparatus includes photometric devices, the technical booklet shall explain at least their function and their correspondence to the photometric prescriptions of the different headlamp beams.

12 Optical apparatus with photometric devices

12.1 Beam axis photometry

12.1.1 If photometric devices are incorporated in an optical apparatus, one of them at least shall allow measurement of the luminous intensity in the beam axis (of main beams).

12.1.2 This device shall be calibrated in kilocandelas up to at least 125 kcd, or in equivalent lux at 25 m up to at least 200 lx.

NOTE 2 The measurement results will therefore be approximately the same as measurements made in a darkroom.

12.1.3 Calibration shall be verified using a lamp the diameter of which does not exceed 120 mm and which emits white light with a colour temperature between 2 800 K and 2 900 K.

The relative error between 10 kcd and 112,5 kcd, or between 16 lx and 180 lx at 25 m, shall not exceed 15 %.

12.2 Beam photometry

12.2.1 If the optical apparatus is equipped with several photometric devices for measuring or comparing luminous intensities in different directions, in order to assess the orientation and the quality of the luminous beams, their relative sensitivities shall not differ by more than 10 % in the useful ranges according to the photometric prescriptions for these luminous beams.

12.2.2 The sensitivity variation of these photometric devices with the entry location on the optics shall be verified using a pinpoint light source placed successively:

— in front of the optical centre,

— 70 mm to left and to right of this centre,

— 50 mm above and below this centre.

For each photometric device, the weakest of the five responses shall be at least 80 % of the strongest.