GCC STANDARDIZATION ORGANIZATION (GSO)

MOTOR VEHICLE HEAD LAMPS - SAFETY REQUIREMENTS
Foreword

GCC Standardization Organization (GSO) is a regional Organization which consists of the National Standards Bodies of GCC member States. One of GSO main functions is to issue Gulf Standards through specialized technical committees (TCs).

GSO through the technical program of committee TC No.:2-1 " The Gulf technical Subcommittee for vehicles and tyres standards " has updated the GSO Standard No. : 1503/2002" MOTOR VEHICLE HEAD LAMPS - SAFETY REQUIREMENTS". The Draft Standard has been prepared by Kingdom of Saudi Arabia.

This standard has been approved as Gulf Technical Regulation by GSO Board of Directors in its meeting No..../.... .......held on  /   /   H ,  /   / The approved standard will replace and supersede the standard No. (   /   )
CONTENTS

Section 1: Road Vehicles Lighting Vocabulary.
Section 2: Installation of Lighting for Motor Vehicles.
Section 3: Road Vehicles - Levelling Devices for Dipped Beam Head Lamp.
Section 4: Motor Vehicles - Measurement of Variation in Dipped beam Head Lamp Angles as a Function of Load.
Annex B: Head Lamp Classification and Examples of Measurement Methods.

References.
SECTION 1

ROAD VEHICLES LIGHTING VOCABULARY

1.1 Scope and field of application
This standard defines terms relating to lighting and light signaling devices for road vehicles as Gulf standard to be approved by GSO concerned with “Road vehicles – types – terms and definitions*.

1.2 Reference
Gulf standard to be approved by GSO concerned with “Road vehicles - types - Terms and definitions”.

1.3 Terms and definitions
Note: In certain countries and international organizations, the term “light” is sometimes used instead of “lamp”.

1.3.1 Light: Visible radiant energy.

1.3.2 Light source: Emitter of visible and radiant energy.

1.3.3 Lamp: Device designed to illuminate a surface (lighting device / head - lamp) or to emit a light signal (signaling device).

1.3.4 Filament bulb; filament lamp:
Device in which light is produced by means of one or more filaments heated to incandescence by the passage of an electric current.

1.3.5 Discharge bulb; discharge lamp:
Device in which light is produced by an electrical discharge through a gas, a metal vapour or a mixture of gases and vapours.

1.3.6 Sealed - beam lamp:
Lamp the components of which usually include a reflector of glass, metal or other material, a lens with optical elements and one or more light sources, forming an indivisible joined, hermetically sealed unit which cannot be dismantled without rendering the unit completely unusable.

1.3.7 Single lamp

* This standard will be based on ISO 3833.
For the purposes of this Gulf Standard, a single lamp also means any assembly of two or more lamps, whether identical or not, having the same function and emitting light of the same colour, if it comprises devices, the projection of aggregate illuminating surfaces of which in a given transverse plane occupies 60% or more of the area of the smallest rectangle enclosing the projection of those illuminating surfaces, provided that the assembly complies with the specification for such a lamp. This possible assembly does not apply to main beam headlamps, dipped-beam headlamps and front fog lamps.

1.3.8 **Equivalent lamps:**
Lamps which have the same function and are geometrically interchangeable.

1.3.9 **Independent lamps:**
Lamps which have separate illuminating surfaces, separate light sources and separate lamp bodies.

1.3.10 **Grouped lamps:**
Devices which have separate illuminating surfaces and separate light sources, but a common lamp body.

1.3.11 **Combined lamps:**
Devices which have separate illuminating surfaces, but a common light source and a common lamp body.

1.3.12 **Reciprocally incorporated lamps:**
Devices which have separate light sources (or a single light source operating under different conditions), totally or partially common illuminating surfaces and a common lamp body.

1.3.13 **Concealable lamp:**
Lamp capable of being partly or completely hidden when not use. This result may be achieved by means of movable cover, by displacement of the lamp or by any other suitable means.

The term “retractable” is used more particularly to describe a concealable lamp which can be withdrawn within body work.

1.3.14 **Dipped - beam headlamp; lower beam head lamp:**
Lamp used to illuminate the road ahead of the vehicle without causing undue dazzle or discomfort to incoming drivers and other road-users.

1.3.15 **Main - beam headlamp; upper beam head lamp:**
Lamp used to illuminate the road over a long distance ahead of the vehicle.

1.3.16 **Front fog lamp:**
Lamp used to improve the illumination of the road under conditions of fog or other conditions which adversely affect visibility.

1.3.17 **Illuminating surface of a lighting device:**
Orthogonal projection of the full aperture of the reflector in a transverse plane.

If the lighting device has no reflector, the definition of the illuminating surface of the signaling device shall be applied. If the lamp lens(es) extend(s) over part only of the reflector, then the projection of that part only is taken into account.

In the case of dipped-beamlamp, having a screened light source giving a defined cut-off, the illuminating surface is limited by the apparent trace of the cut-off on to the lens. If the reflector and glass are adjustable relative to one another, the mean adjustment should be used.

1.3.18 **Illuminating surface of a reflex reflector:**
Illuminating surface of a reflex reflector in plane perpendicular to the reference axis and bounded by planes on the outer edges of the reflex reflector light projection surface and parallel to this axis.

1.3.19 **Light-emitting surface:**
All or part of the exterior surface of the transparent lens that encloses the lighting and light signaling devices and conforms to certain defined photometric and colourmetric conditions.

1.3.20 **Apparent surface (for a defined observation direction):**
Orthogonal projection of the light-emitting surface on a plane perpendicular to the observation direction and coinciding with the point on the lens closest to the observer.

1.3.21 **Reference axis:**
Characteristic axis of the light signal for use as the reference direction (H = 0°, V = 0°) for photometric measurements and when fitting the lamp on the vehicle.

1.3.22 **Reference center:**
Intersection of the reference axis with the light-emitting surface.

1.3.23 **Angles of geometric visibility of a lamp:**
Angles which determine the widest solid angle in which the apparent surface of the lamp is visible.

This solid is determined by the segments of a sphere in which the center coincides with the reference center of the lamp and the equator is parallel to the ground. These segments are determined in relation to the reference axis. The horizontal angles correspond to the longitude and the vertical angles to the latitude.

1.3.24 **Headlamp cleaner:**
System with which all or part of the light emitting surface of headlamp can be cleaned.
1.3.25  **Head lamp leveling device;**

*Note: Head lamp levelling device is considered to be optional*

System with which the beam inclination can be corrected in relation to the changes of vehicle attitude.
SECTION - 2

INSTALLATION OF LIGHTING FOR
MOTOR VEHICLES

2.0 Scope and field of application

This standard defines the essential characteristics for the installation of lighting devices on motor vehicles(1) intended for use on the road with the exception of vehicles which run on rails, agricultural or forestry tractors and machinery, and oil field vehicles, and public works vehicles and similar.

Attention is drawn to the fact that some of these requirements may be modified or up -dated to take account of technical and regulatory) development.

2.1 Mounting devices

The lighting devices shall be so fitted that under normal conditions of use, and withstanding any vibration to which they may be subjected, they retain the characteristics laid down in, and enable the vehicle to comply with the requirements of, this international standard. In particular, it shall not be possible for the adjustment of the lamps to be inadvertently disturbed.

2.2 Adjustment of setting

The main- beam, dipped- beam and front fog lamps shall be capable of being easily adjusted to permit them to be carefully oriented.

2.3 Angles of geometric visibility

The horizontal angles shall be $B_1$ corresponding to the longitude outboard and $B_2$ corresponding to the longitude in board and the vertical angles shall be $\alpha_1$ corresponding to the up latitude and $\alpha_2$ corresponding to the down latitude.

There shall be no obstacle within the angles of geometric visibility to the spread of light from any part of the apparent surface of the lamp observed from infinity.

If measurements are taken closer to the lamp, the direction of observation must be moved in parallel to achieve the same accuracy.

On the inside of the angles of geometric visibility, no account is taken of obstacles if they were already present when the lamp was tested.

If, when the lamp is installed, any part of the apparent surface of the lamp is hidden by any further parts of the vehicle, proof shall be provided that the part

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(1) This standard applied at the present stage only to motor vehicles having at least four wheels. However work will be initiated in to define the installation of lighting devices for vehicles having two and / or three wheels (motorcycles and mopeds).
of the lamp not hidden by obstacles still conforms to the photometric values set for the device.

2.4 **Check of alignment and height**

In the absence of specific requirements, the height and alignment of the lamps shall be checked with the unloaded vehicle on the ground.

2.5 **Lamps constituting a pair**

*In the absence of specific requirements, lamps constituting a pair shall*

- a) be fitted to the vehicles symmetrically in relation to the median longitudinal plane (this estimate shall be based on the exterior geometrical form of the lamp and not on the edge if its illuminating surface;
- b) be symmetrical to be one another in relation to the median longitudinal plane (not applicable to the interior structure of the lamp);
- c) satisfy the same colourmetric characteristics;
- d) have substantially identical photometric characteristics.

2.6 **Vehicles with asymmetrical external shape**

On vehicles the external shape of which is asymmetrical, the requirements in clause 2.5 shall be met as far as possible.

2.7 **Maximum and minimum heights** *(See diagrams in Figs. 1,2,3)*

The maximum height \(H_1\) above ground shall be measured from the highest point and minimum height \(H_2\) from the lowest point of the illuminating surface.

When height requirements are substantially met, it is sufficient to refer to the actual lamp edges.

In the case of dipped headlamps, the minimum height in relation to the ground shall be measured from the lowest edge of the reflector.

2.8 **Electrical connections**

The electrical connections shall be such that the main beam and dipped - beam headlamps, and the front and rear fog lamps cannot be switched on unless the lamps are also switched on. This requirement shall not apply, however, to main-beam or dipped beam headlamps when luminous warnings are given by the intermittent illuminating at short intervals of the main-beam headlamps or the alternate illuminating.

2.9 **Lamp colours**

The colours of the light emitted by the lamps or reflectors are as follows
Main-beam headlamp: white or selective yellow
Dipped-beam headlamp: white or selective yellow
Front fog lamp: white or enlarged selective yellow

2.10 Concealable lamps

2.10.1 The concealment of lamps shall be prohibited, with the exception of the main-beam headlamp, the dipped-beam headlamp and the front fog lamp which may be concealed when not in use.

2.10.2 An illuminating device in the position of use shall remain in that position if the malfunction referred to in a) occurs alone or in conjunction with one of the malfunctions described in b):

   a) the absence of power for manipulating the lamp;
   b) a break, impedance, or short circuit to earth in the electrical circuit, defects in the hydraulic or pneumatic lines, flexible cables, solenoids or other components controlling or transmitting the energy intended to activate the concealment device.

2.10.3 In the event of a defect in the concealment control or other defects referred to in sub clause 2.10.2 a) and b), a concealed lighting device shall be capable of being moved into the position of use without the aid of tools.

2.10.4 It shall be possible to move illuminating devices into the position of use and to switch on by means of a single control, while allowing the possibility of moving them into the position of use without switching them on. However in the case of grouped main-beam and dipped-beam headlamps, the control referred to above is required only to activate the dipped beam headlamps.

2.10.5 It shall not be possible, from the driver's seat, deliberately to stop the movement illuminated headlamps before they reach the position of use. If there is a danger of dazzling other road users by the movement of headlamps, they may illuminate only when they have reached their final position.

2.10.6 Within the temperature range -30 to +50°C, the concealment device shall allow the headlamp to be fully exposed within 3 s of initial operation of the control.
Fig. 1 Dipped - Beam Head Lamp
2.11 Dipped - Beam Head Lamp

a) Application
   For motor vehicles only

b) Number
   2

c) Dimensions (in millimeters)
   \( H_1 \leq 1500 \)
   \( H_2 \geq 500 \)
   E:
   D:

d) Configuration
   May be grouped with the main - beam head lamp and the other front lamps.
   May not be combined with any other lamp
   May be reciprocally incorporated
     – with the main beam head lamp, unless the latter swivels with the steering

e) Angles of range geometric visibility
   \( \alpha_1: 2^\circ - 15^\circ \)
   \( \alpha_2: 4^\circ - 10^\circ \)
   \( B_1: 12^\circ - 45^\circ \)
   \( B_2: 10^\circ - 12^\circ \)

f) Adjustment of dipped beam
   Note: the adjustment system of dipped beam is optional
   The vertical inclination of the dipped beam shall be measured under static conditions and all the loading conditions defined in relevant standard*.
   The initial adjustment for each type vehicle shall be expressly laid down by the manufacturer.

g) Electrical connections

* This standard will be based on ISO 4182.
The control for changing over to the dipped-beam headlamps simultaneously.

The dipped beams may remain switched on at the same time as the main beams.

Fig. 2 - Main-Beam Head Lamp
2.12 Main-beam headlamp

a) Application
For motor vehicles only

b) Number
2 or 4

c) Dimensions (in millimeters)

\[ \begin{align*}
H_1 : & \quad \text{——} \\
H_2 : & \quad \text{——} \\
\end{align*} \]

\( E \geq \text{dipped beam} \)

D : ——

d) Configuration
May be grouped with the dipped-beam headlamp and other front lamps.
May not be combined with any other lamp.
May be reciprocally incorporated
– With the dipped-beam headlamp;
– With the front position lamp;
– With front fog lamp.
– With the parking lamp.

e) Angles Range of geometric visibility
\[ \begin{align*}
\alpha_1 : & \quad 2^\circ \rightarrow 5^\circ \\
\alpha_2 : & \quad 4 \rightarrow 5^\circ \\
B_1 : & \quad \text{——} \\
B_2 : & \quad \text{——} \\
\end{align*} \]

f) Electrical connections
The main-beam headlamps may be switched on whether simultaneously or in pairs. For changing over from the main to the dipped beam, all main-beam headlamps shall be switched off simultaneously.

The dipped beams may remain switched on at the same time as the main beams.
Fig. 3 - Front fog lamp
2.13 **Front fog lamp:**

a) **Application**
   For motor vehicles only

b) **Number:** 2

c) **Dimensions (in millimeters)**
   \[ H_1 : \text{No point on the illuminating surface shall be higher than the highest point of the illuminating surface of the dipped-beam headlamp} \]
   \[ H_2 \geq 250 \]
   \[ E : —— \]
   \[ D : —— \]

d) **Configuration**
   May be grouped with other front lamps.
   May not be combined with other front lamps.
   May be reciprocally incorporated.

   – With main-beam headlamps, unless these swivel with the steering:
     – With front position lamps;
     – With the parking lamp.

e) **Angles range of geometric visibility**
   \[ \alpha_1 : 4^\circ — 5^\circ \]
   \[ \alpha_2 : 3^\circ — 5^\circ \]
   \[ B_1 : 15^\circ — 45^\circ \]
   \[ B_2 : 10^\circ \]

f) **Electrical connections**
   It shall be possible to switch the fog lamps on and off independently of the main- or dipped-beam headlamps and vice versa.

   *Note: In some countries front fog lamps shall not be switched on when high beam headlamps are activated.*
3.1 General specifications

3.1.1 If manual leveling devices are used, either continuously or through a series of positions, they shall have marked “0” position where the lamps can be put back to the initial alignment defined in relevant standard* for dipped beams (passing beams) by means of the usual adjusting screws.

3.1.2 These manual leveling devices shall be operated from the driving seat.

3.1.3 Continuous levelling devices shall have reference marks near the control indicating:
   a) the initial loading condition
   b) the main loading conditions that require adjustment of the dipped beam.

3.1.4 The number of positions on discontinuous leveling devices or devices operating with a series of positions shall be such as to ensure compliance, starting from an initial downwards inclination, with the range of values for the loading conditions as defined in relevant standard**.

   For these devices,
   a) the initial loading condition and
   b) the loading conditions that require adjustment of the dipped beam.

   Shall be clearly marked near the control of the device.

3.2 Controls for headlamp levelling device

3.2.1 Downward inclination of the dipped beam shall be produced in one of the following ways:
   a) by moving a control downwards or to the left or forwards:
      b) by depressing or touching a button (push control or touch key). In this case the button or the key which gives the downward inclination shall be installed to the left or below the button(s) for other dipped beam positions.

* This standard will be based on ISO 303
** This standard will be based on ISO 4182
A rotary control which is installed edge-on (examples 4 and 5 in figure 5) shall follow the operating principle of controls of type a). The same applies to electrical controls using a rocker switch.

3.2.2 On or near the control, symbols shall indicate clearly the movements corresponding to the downwards and upwards inclination of the dipper beam.

3.2.3 The marked “0” position corresponds to the initial alignment specified in 3.1.1

3.2.4 The marked “0” position, as in 3.1.1, need not be at the end of the scale: it shall be identified unambiguously.

3.2.5 The marking specified in 3.2.2 shall be explained in the owner’s handbook.

3.2.6 Only the symbols shown in figure 4 may be used to identify headlamp levelling control.

3.2.7 The examples given figure 5, as to how symbols shown in figure 4 should be used, are not restrictive.

![Basic symbol](image)

![Permitted symbols](image)

Fig. 4 - Headlamp levelling device control symbols
Figure 5- Examples of use of symbols
Section 4

MOTOR VEHICLES - MEASUREMENT OF VARIATIONS IN
DIPPED-BEAM HEADLAMP ANGLE AS A FUNCTION OF LOAD

4.1 SCOPE

This Section specifies a method of measuring variations in the dipped-beam inclination of motor vehicle head lamps, 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.

4.2 Normative References

4.2.1 The standard to be approved by GSO concerned with “Road Vehicles - Installation of lighting and signaling devices for motor vehicles and their trailers”\(^{(1)}\).

4.2.2 The standard to be approved by GSO concerned with “Road vehicles - Dimensions of motor vehicles and towed vehicles - Terms and definitions”\(^{(2)}\).

4.2.3 The standard to be approved by GSO concerned with “Road vehicles - Types - terms and definitions”\(^{(3)}\).

4.2.4 The standard to be approved by GSO concerned with “Road vehicles – lighting and light signaling devices – vocabulary”\(^{(4)}\).

4.3 Definitions

In this Gulf standard, vehicles defined on sub clauses 4.2.2, 4.2.3 are classified as follows:

\(^{(1)}\) This standard will be based on ISO 303
\(^{(2)}\) This standard will be based on ISO 612
\(^{(3)}\) This standard will be based on ISO 3833
\(^{(4)}\) This standard will be based on 7227
4.3.1 Classification

4.3.1.1 Vehicle, category M: Motor vehicle intended for transporting people.

4.3.1.2 Vehicle, category M₁: Motor vehicle, category M (4.3.1.1), containing not more than eight seats, in addition to the driver’s seat.

4.3.1.3 Vehicle, category M₂: Motor vehicle category M (4.3.1.1), containing more than 8 seats, in addition to the driver’s seat, and having a maximum permissible mass not exceeding 5t.

4.3.1.4 Vehicle, category M₃: Motor vehicle, category M (4.3.1.1), containing more than 8 seats, in addition to the driver’s seat, and having a maximum permissible mass exceeding 5 t.

4.3.1.5 Vehicle, category N: Motor vehicle intended for transporting goods.

4.4 Initial inclination

4.4.1 Stated initial inclination: value of the dipped-beam initial inclination specified by the motor vehicles manufacturer, which serves as a reference value for the calculation of permissible variation.

4.4.2 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.

4.5 Reference center

Intersection of the reference axis with the light-emitting surface sub-clause 4.2.4.

4.6 Type of vehicle

For the purposes of this standard, vehicles shall be considered to be of the same type they do not differ in such essential respect as:

– wheel - base (wheel space)
– location of the headlamps on the motor vehicle;
– headlamp class, (see annex B);
– characteristics of the suspension system;
– axle load stated by correct dipped beam angle according to load.
– means used to correct dipped – beam angle according to load.

4.7 Dipped - beam inclination

The dipped – beam inclination is defined as follow:

– either as the angle, expressed in milliradians, between the direction of a characteristic point in the luminous spread of the headlamp and the horizontal plane; or
by the tangent of that angle, expressed in percent, since the angles are small (for those small angles, 1% is equal to 10 mrad.)

If the inclination is expressed in percent, it can be calculated by the formula.

\[
\frac{h_1 - h_2}{L} \times 100
\]

where

- \( h_1 \) is the height above the ground, in millimeters, of a characteristic point in the luminous spread of the head lamp, measured on a vertical screen perpendicular to the vehicle longitudinal medium plane, placed at a horizontal distance \( L \):
- \( h_2 \) is the height in millimeters, of the reference center (4.5) above the ground;
- \( L \) is the distance, in millimeters, from the screen to the reference center (4.5).

Negative values denote downward inclination (see figure 6). Positive values denote upward inclination.

Notes

1) This drawing represents a category M1 vehicle, but the principle shown applies equally to vehicles of other categories.

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

Figure 6
Dipped-beam downward inclination of a category M1 vehicle

4.8 Measurement conditions
4.8.1 If 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 screen to be placed as shown in figure 6.

Headlamp centers of reference shall be at a distance from the screen of at least 10 m.

4.8.2 The ground on which measurements are made shall be as flat and horizontal as possible, so that the reproducibility of measurements of dipped-beam angle can be ensured to an accuracy of ± 0.5 mrad (± 0.05 % inclination).

4.8.3 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 measurements of beam angle can be ensured to an accuracy of ± 0.5 mrad (± 0.05 % angle).

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

4.9 Vehicle preparation

4.9.1 Measurements shall be carried out on a vehicle which has traveled a distance of 1000 to 10000 km, and preferably about 5000 km.

4.9.2 Tyres shall be installed to the full load pressure specified by the manufacturer. The vehicle shall be fully replenished (fuel, water, oil) and equipped with all 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.*

4.9.3 The vehicles shall have the parking brake released and the gear box in neutral.

4.9.4 The vehicles shall be conditioned for at least 8 h at the temperature specified in sub clause 4.8.4

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

Other means are allowed to obtain a precise reading (for example removal of headlamp lens).

4.10 TEST PROCEDURE

4.10.1 General
The variations in dipped beam angle or the variations in vehicle angle, according to the method chosen, shall be measured separately for each side of the vehicle. The results obtained on both left and right headlamps, under all load conditions specified in annex A, shall be within the limits set in 4.10.5. The load shall be applied gradually, without subjecting the vehicle to excessive shocks.

4.10.2 Determination of the measured initial inclination

4.10.2.1 The vehicles shall meet the conditions specified in clause 4.9 and be laden as specified in annex A in the first clause of the appropriate vehicle category. Before such measurement, the vehicle shall be rocked as specified in 4.10.4. Measurements shall be taken three times.

4.10.2.2 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.

4.10.2.3 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 10 new measurements shall constitute the final result.

4.10.3 Measurement methods

Depending on the headlamp class as defined in various measurement methods are applicable, provided that the readings are within an accuracy of $\pm 0.2$ mrad ($\pm 0.02$ % inclination).

4.10.4 Treatment of vehicle in each loading condition

4.10.4.1 Activation of vehicle suspension

The vehicle suspension and any other parts likely to affect dipped beam inclination shall be activated according to the method described in 4.10.4.2 to 4.10.4.3. However, in agreement with the test laboratories, manufacturers may offer other methods (either experimental or based upon calculations), especially when experiments present special difficulties and when such calculations are clearly valid.

4.10.4.2 M1 category vehicles with conventional suspension

With the vehicles standing on the measuring site and, if necessary, with the wheels resting on floating platforms (which shall be used only if their absence.

Would lead to restriction of the suspension movement, likely to affect the results of measurement, rock the body lengthwise as follows:

Rock the vehicle continuously for at least three complete cycles, for each cycle first the rear and then 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 revaluation.

4.10.4.3 **M₂, M₃ and N category vehicles with conventional suspension**

4.10.4.4 If the treatment method for category M₁ vehicles described in 4.10.4.2 is not possible, the method described in 4.10.4.5 or 4.10.4.6 may be used.

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

4.10.4.6 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.
4.10.5  **Measurements**

4.10.5.1  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 4.10.2 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).

4.10.5.2  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).

4.10.5.3  If the result(s) of any measurement(s) does (do) not lie within the safety margin indicated 4.10.5.2 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 4.10.5.4.

4.10.5.4  For each of the above loading conditions:

4.10.5.4.1  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.

4.10.5.4.2  If any measurement differs from the arithmetic means of the results by more than 2 mard (0.2 % inclination), a further series of 10 measurements shall be made, the arithmetic mean of which shall constitute the final result.

4.10.5.4.3  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 4.10.5.4.1 and 4.10.5.4.2.

4.10.5.5  Requirements have been met if, under all loading conditions, the variation between the measured initial inclination determined in accordance with 4.10.2 and the inclination measured under each loading condition is less than the values calculated 4.10.5.2 (without safety margin).

4.10.5.6  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 M₁ category 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 near 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.

A.2.2 Category M₂ and M₃ vehicles

The angle of the light beam from the dipped-beam headlamps must be determined under the following loading conditions.

A.2.2.1 Condition No. 1

Vehicle unladen and one person in the driver’s seat.

A.2.2.2 Condition No. 2

Vehicles laden such that each axle carried its maximum technically permissible mass of the vehicle, is attained by loading the front and rear axles proportionally to their maximum technically permissible loads, which occurs first.

A.2.3 Category N vehicles with a load surfaces

The angle of the light beam from the dipped-beam headlamps must be determined under the following loading conditions.

A.2.3.1 Condition No. 1

Vehicle unladen and one person in the driver’s seat.

A.2.3.2 Condition No. 2

The 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 load. Conversely, the front axle is so considered when the load platform is at the front.

A.2.4 Category N vehicles without a load surface

A.2.4.1 Towing vehicles for semi-trailers

A.2.4.1.1 Condition No. 1

Unladen vehicle without a load on the coupling attachment and one person in the driver’s seat.

A.2.4.1.2 Condition No. 2

One person in the driver’s seat: technically permissible load on the coupling attachment in the position of the attachment corresponding to the highest load on the rear axle.

A.2.4.2 Towing vehicles for trailers
A.2.4.2.1  Condition No. 1
Vehicle unladen and one person in the driver’s seat.

A.2.4.2.2  Condition No. 2
Open person in the driver’s seat, all the other places in the driving cabin occupied.
Annex B
(normative)

Headlamp Classification And Examples of Measurement Methods.

B.1 Introduction
Examples are given in B.3 of different methods of assessing the variation in dipped - beam angle. However, some of these methods are not applicable to vehicles 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 B.2; applicable measurement methods are indicated for each class of the headlamp.

B.2 Applicable methods

B.2.1 Class I
Headlamps which are fixed rigidly to the vehicle frame or body work, 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. 3. 1 a) or B.3.1 b)
B. 3. 2 a) or B.3.2 b)
B. 3. 3 a) or B.3.3 b)

B.2.2 Class II
Headlamps which are re- settable (manually or automatically) with respect to the vehicle frame or body work as a function of changes vehicle loading.

Applicable methods: B. 3. 1 a) or B. 3. 1 b)
B.3.2 a) or B. 3. 2 b)

B.2.3 Class III
Headlamps which the lens is rigidly fixed to the vehicle frame or body work, but in which the reflector or other optical elements are re- settable(manually or automatically) as a function of changes in vehicle loading.

Applicable methods: B.3.1.a or B.3.1.b
B.3 Measurement methods

Note: The examples given B.3.1 to B.3.3 are not intended to provide a comprehensive list: other suitable methods may be used by agreement with the test laboratory.

B.3.1 Direct measurement of dipped-beam angle

The dipped beam shall be projected on to a screen. The distance (L) from the screen to the reference center of the headlamp shall not less than 10 m. All measurements of angle and variation shall be taken from a chosen characteristic point in the dipped-beam pattern. The lens may be masked partially to increase the sharpness of the beam pattern on the screen. If the dipped-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).

B.3.1.1 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.

B.3.1.2 Method b): Direct measurement by photometric means

The position of the characteristic point, and the variation 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.3.2 Measurement of the headlamp orientation in the vertical plane

B.3.2.1 Method a): Measurement by laser and mirror.

A plane mirror, of good optical quality and with the reflective coating on its exposed surface, shall be mounted in the center 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.

B.3.2.2 Method b): Measurement by 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.3.3 Measurement of vehicle attitude

B.3.3.1 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 center.

B.3.3.2 **Method b): Measurement by inclinometer**

The inclinometer shall be attached securely to a suitably rigid part of the vehicle frame or body work.
Annex C
(normative)

Photometric Method of Determining The Position of a Point of The Conventional Cut-Off

C.1 Definition of conventional cut-off
For the purposes of this international standard, the horizontal part of the conventional cut-off is considered as being that point where beam intensity, expressed in candles, is equal to:

\[ I = 0.15 \times I_1 + 500 \]

Where \( I_1 \) represents the beam intensity at \( 1^\circ \) below the direction of intensity \( I \).

This definition applies only to the determination of the chosen characteristic point of the cut-off reference position whenever dipped-beam variation is checked. The angular diameter of the photoelectric cell shall be approximately 1 mrad.

C.2 Measurement method
Carry out measurements in a dark room, taking care to eliminate reflections on floor and side walls completely.

The measurement system may consist of two photoelectric cells fitted with neutral colour filters having such light transmittance factors that the output signals have a ratio of 1 to 0.15 and are arranged as in figure 7.

Compare the light signals with an indicator the zero point of which is equivalent to 500 cd light signal. Tolerance on the 0.15 ratio and in intensity shall not exceed 5 %.

Take the measurement by moving the photoelectric cell support vertically until the indicating reading is zero. The characteristic point of the cut-off corresponds to the center of the uppermost photoelectric cell.
1) Photoelectric receiver for l
2) Photoelectric receiver for l₁
3) Photoelectric receiver for support (black, with chamfered edges)

Figure - 7
Photoelectric receiver arrangement on screen for l = 10 m (see figure 6)
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