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World Forum for Harmonization of Vehicle Regulations**Working Party on Lighting and Light-Signalling****Seventy-third session**

Geneva, 14 – 17 April 2015

Item 6 (b) of the provisional agenda

Regulation No. 48 (Installation of lighting and light-signalling devices) –**Other proposals for amendments to Regulation No. 48****Proposal for the 07 series of amendments to Regulation
No. 48 (Installation of lighting and light-signalling devices)****Submitted by the experts from the International Organization of Motor
Vehicle Manufacturers (OICA) and the International Automotive
Lighting and Light Signalling Expert Group (GTB)***

The text reproduced below was prepared by the experts from OICA and GTB to introduce new criteria on the automatic levelling of headlamps based on the GTB glare and visibility studies. This proposal is for formal consideration and advice from Contracting Parties, with the expectation that a finalised text will be submitted for adoption at the seventy-fourth session of GRE. The modifications to the existing text of the Regulation are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94 and ECE/TRANS/2012/12, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

I. Proposal

Paragraph 2.4., amend to read:

"2.4. "Unladen vehicle" means a vehicle without driver, crew, passengers and load, but ~~with a full supply of fuel, spare wheel and the tools normally carried~~ **including 100 per cent of normal fluids, at least 90 per cent of fuel and, where provided as standard equipment, any tools and the spare wheel.**"

Paragraph 2.5., amend to read:

"2.5. "*Laden vehicle*" means a vehicle loaded to its technically ~~permissible~~ maximum **permissible** mass, as stated by the manufacturer, ~~who shall also fix the distribution of this.~~ **This mass is distributed** between the axles in accordance with the method described in Annex 5."

Insert a new paragraph 2.27., to read:

"2.27. "**Vehicles of category N₁ derived from M₁**" means vehicles in N₁ category which, in front of the A-pillars, are of the same general structure and shape as a pre-existing M₁ category vehicle;"

Insert new paragraphs 6.2.6.1.1. to 6.2.6.1.1.2., to read:

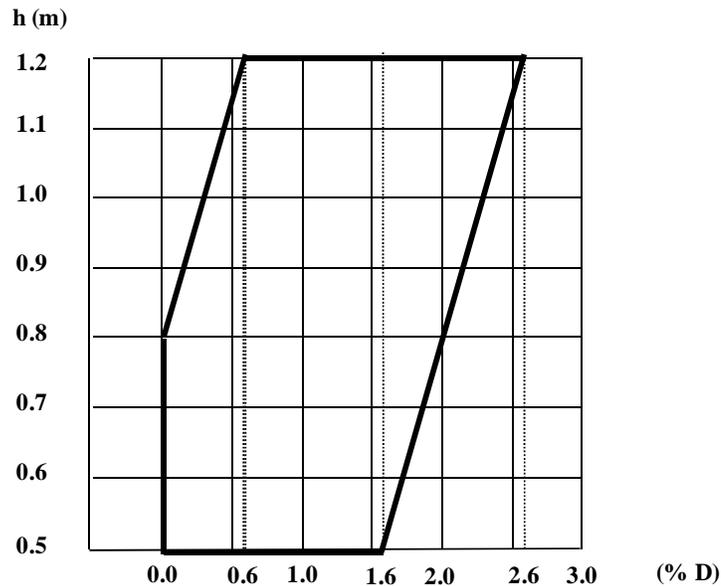
"6.2.6.1.1. **for vehicles in Category M₁ [and, at the discretion of the manufacturer, vehicles in category N₁ derived from M₁]**

6.2.6.1.1.1. **The initial downward inclination of the cut-off of the dipped-beam to be set in the unladen vehicle state with the addition of one person in the driver's seat shall be specified within an accuracy of 0.1 per cent by the manufacturer, and indicated in a clearly legible and indelible manner on each vehicle by the symbol shown in Annex 7 in a location close to either headlamp or the manufacturer's plate.**

The value of this indicated downward inclination shall be defined in accordance with paragraph 6.2.6.1.1.2.

6.2.6.1.1.2. **Depending on the mounting height in metres (h) of the [lower edge of the apparent surface in the direction of the reference axis of the dipped-beam headlamp], measured on the vehicles under the loading conditions prescribed in Annex 5 of this Regulation, the downward inclination of the cut-off of the dipped beam headlamp, starting from the initial inclination value set by the vehicle manufacturer as prescribed in paragraph 6.2.6.1.1.1. above, shall remain between the limits (see diagram below):**

**h = 0.5 m: from 0.0 per cent to -1.6 per cent;
h = 0.8 m: from 0.0 per cent to -2.0 per cent;
h = 1.2 m: from -0.6 per cent to - 2.6 per cent.**



For the intermediate mounting heights, the limits vary linearly between the indicated values.

Insert a new paragraph 6.2.6.1.2., to read

"6.2.6.1.2. for vehicles in all other M and N categories,"

Paragraphs 6.2.6.1.1. to 6.2.6.1.2., amend to read:

6.2.6.1.2.1. The initial downward inclination of the cut-off of the dipped-beam to be set in the unladen vehicle state with **the addition of** one person in the driver's seat shall be specified within an accuracy of 0.1 per cent by the manufacturer and indicated in a clearly legible and indelible manner on each vehicle close to either headlamp or the manufacturer's plate by the symbol shown in Annex 7. The value of this indicated downward inclination shall be defined in accordance with Paragraph **6.2.6.1.2.2.**

6.2.6.1.2.2. Depending on the mounting height in metres (h) of the lower edge of the apparent surface in the direction of the reference axis of the dipped-beam headlamp, measured on the unladen vehicles, the vertical inclination of the cut-off of the dipped-beam shall, under all the static conditions of Annex 5, remain between the following limits and the initial aiming shall have the following values:

$h \leq 0.8$

Limits: between -0.5 per cent and -2.5 per cent

Initial aiming: between -1.0 per cent and -1.5 per cent

$0.8 \leq h \leq 1.0$

Limits: between -0.5 per cent and -2.5 per cent

Initial aiming: between -1.0 per cent and -1.5 per cent

Or, at the discretion of the manufacturer,

Limits: between -1.0 per cent and -3.0 per cent

Initial aiming: between -1.5 per cent and -2.0 per cent

The application for the vehicle type-approval shall, in this case, contain information as to which of the two alternatives is to be used.

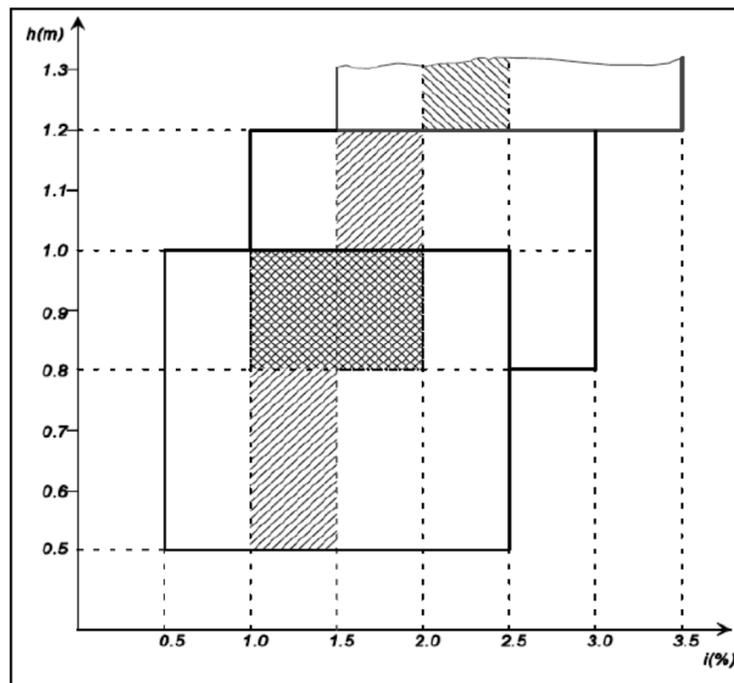
$h \geq 1.0$

Limits: between -1.0 per cent and -3.0 per cent

Initial aiming: between -1.5 per cent and -2.0 per cent

The above limits and the initial aiming values are summarised in the diagram below.

For Category N3G (off-road) vehicles where the headlamps exceed a height of 1,200mm, the limits for the vertical inclination of the cut-off shall be between: -1.5 per cent and -3.5 per cent.



Insert new paragraphs 6.2.6.2.1. to 6.2.6.2.1.4., to read:

- "6.2.6.2.1. For vehicles in category M₁, [and, at the discretion of the manufacturer, vehicles in category N₁ derived from M₁]:
 - 6.2.6.2.1.1. in the case where the vertical inclination limits prescribed in paragraph 6.2.6.1.1.2. of this Regulation are exceeded under the loading conditions defined in paragraph 2.1.1.3. of Annex 5 to this Regulation (50 per cent loading) an automatic headlamp levelling device shall be installed;
 - 6.2.6.2.1.2. in the case where the vertical inclination limits prescribed in paragraph 6.2.6.1.1.2. of this Regulation are not exceeded under the loading condition defined in paragraph 2.1.1.3. of Annex 5 to this Regulation (50 per cent loading), a further verification shall be carried out under the

loading conditions defined in paragraph 2.1.1.7. of Annex 5 to this Regulation. In the case where the vertical inclination limits prescribed in paragraph 6.2.6.1.1.2. of this Regulation are exceeded under this loading condition either a manual levelling device or an automatic levelling device shall be installed.

- 6.2.6.2.1.3.** Where a headlamp levelling device is used, it shall ensure that the vertical inclination limits prescribed in paragraph 6.2.6.1.1.2. of this Regulation are not exceeded under the loading conditions defined in Annex 5, paragraph 2.1.

Where a manual levelling device is used, it may be adjusted either continuously or non-continuously, provided it has a stop position with which the headlamps can be returned to the initial inclination defined in paragraph 6.2.6.1.1.1. by means of the usual adjusting screws or similar means.

This manually adjustable device shall be operable from the driver's seat.

For this device, the loading conditions defined in paragraph 2.1. of Annex 5 that require adjustment of the dipped-beam shall be clearly marked near the control of the device (see Annex 8).

- 6.2.6.2.1.4.** In the event device failure as described in paragraph 6.2.6.2.1.3., the cut-off line of the dipped-beam shall not assume a position higher than at the time when the failure of the device occurred."

Insert a new paragraph 6.2.6.2.2., to read

"6.2.6.2.2. For vehicles in all other M and N categories,"

Paragraphs 6.2.6.2.2.1. to 6.2.6.2.2.3., amend to read:

- "6.2.6.2.2.1.** In the case where a headlamp levelling device is necessary to satisfy the requirements of paragraphs 6.2.6.1.2.1. and 6.2.6.1.2.2., the device shall be automatic.

- 6.2.6.2.2.2.** However, devices which are adjusted manually, either continuously or non-continuously shall be permitted, provided they have a stop position at which the lamps can be returned to the initial inclination defined in paragraph 6.2.6.1.2.1. by means of the usual adjusting screws or similar means.

These manually adjustable devices shall be operable from the driver's seat.

Continually adjustable devices shall have reference marks indicating the loading conditions that require adjustment of the dipped-beam.

The number of positions on devices which are not continuously adjustable shall be such as to ensure compliance with the range of values prescribed in paragraph 6.2.6.1.2.2. in all the loading conditions defined in Annex 5.

For these devices also, the loading conditions of Annex 5 that require adjustment of the dipped beam shall be clearly marked near the control of the device (see Annex 8).

- 6.2.6.2.2.3.** In the event of a failure of devices described in paragraphs ~~6.2.6.2.1. and 6.2.6.2.1.~~ 6.2.6.2.2.1. and 6.2.6.2.2.2., the dipped-beam shall not assume a position in which the dip is less than it was at the time when the failure of the device occurred."

Paragraph 6.2.9., amend to read:

"6.2.9. Other requirements

The requirements of paragraph 5.5.2. shall not apply to dipped-beam headlamps.

Only dipped-beam headlamps according to Regulations Nos. 98 or 112 may be used to produce bend lighting.

If bend lighting is produced by a horizontal movement of the whole beam or the kink of the elbow of the cut-off, it shall be activated only if the vehicle is in forward motion; this shall not apply if bend lighting is produced for a right turn in right hand traffic (left turn in left hand traffic).

Dipped-beam headlamps with a light source or LED module(s) producing the principal dipped beam and having a total objective luminous flux which exceeds 2,000 lm shall only be installed in conjunction with the installation of headlamp cleaning device(s) according to Regulation No. 45.⁽¹⁾

For vehicles in categories M and N other than vehicles in category M₁ [and, at the discretion of the manufacturer, vehicles in category N₁ derived from M₁], with respect to vertical inclination the provisions of paragraph ~~6.2.6.2.2.~~ **6.2.6.2.2. above shall not be applied for dipped-beam headlamps:**

(a) ~~With LED module(s) producing the principal dipped beam, or~~

(b) ~~W~~ with a light source producing the principal dipped-beam and having an objective luminous flux which exceeds 2,000 lumens.

In the case of filament lamps for which more than one test voltage is specified, the objective luminous flux which produces the principal dipped-beam, as indicated in the communication form for the type approval of the device, is applied.

In the case of dipped-beam headlamps equipped with an approved light source, the applicable objective luminous flux is the value at the relevant test voltage as given in the relevant data sheet in the Regulation, according to which the applied light source was approved, without taking into account the tolerances to the objective luminous flux specified on this datasheet.

~~Only dipped beam headlamps according to Regulation Nos. 98 or 112 may be used to produce bend lighting.~~

~~If bend lighting is produced by a horizontal movement of the whole beam or the kink of the elbow of the cut-off, it shall be activated only if the vehicle is in forward motion; this shall not apply if bend lighting is produced for a right turn in right hand traffic (left turn in left hand traffic). "~~

Paragraphs 6.22.6.1. to 6.22.6.1.2., amend to read:

"6.22.6.1. Vertical orientation:

6.22.6.1.1. The initial downward inclination of the cut-off of the basic passing-beam to be set in the unladen vehicle state **with the addition of** one person in the driver's seat shall be specified ~~within an precision accuracy~~ of 0.1 per cent

¹ Contracting Parties to the respective Regulations can still prohibit the use of mechanical cleaning systems when headlamps with plastic lenses, marked 'PL', are installed.

by the manufacturer and indicated in a clearly legible and indelible manner on each vehicle, close to either the front lighting system or the manufacturer's plate, by the symbol shown in Annex 7.

Where differing initial downward inclinations are specified by the manufacturer for different lighting units that provide or contribute to the cut-off of the basic passing-beam, these values of downward inclination shall be specified within an ~~precision~~ accuracy of 0.1 per cent by the manufacturer and indicated in a clearly legible and indelible manner on each vehicle, close to either the relevant lighting units or on the manufacturer's plate, in such a way that all the lighting units concerned can be unambiguously identified.

- 6.22.6.1.2. The downward inclination of the horizontal part of the "cut-off" of the basic passing-beam shall remain between the limits indicated in paragraph **6.2.6.1.1 for vehicles in category M₁ [and, at the discretion of the manufacturer, vehicle in category N₁ derived from M₁] and 6.2.6.1.2. for vehicles of all other categories** of this Regulation under all the static loading conditions of the vehicle of Annex 5 of this Regulation; and the initial aiming shall be within the specified values.
- 6.22.6.1.2.1. In case the passing-beam is generated by several beams from different lighting units, the **relevant requirements** ~~provisions according to paragraph 6.22.6.1.2. as above indicated~~ apply to each said beam's "cut-off" (if any), which is designed to project into the angular zone, as indicated under item 9.4. of the communication form conforming to the model in Annex 1 to Regulation No. 123."
- 6.22.6.2. Headlamp levelling device
- 6.22.6.2.1. In the case where a headlamp levelling device is necessary to satisfy the requirements of paragraph 6.22.6.1.2., the device shall be automatic.
- 6.22.6.2.2. In the event of a failure of this device, the **cut-off line of the basic** passing-beam shall not assume a position **higher than** ~~in which the downward inclination dip is less than~~ it was at the time when the failure of the device occurred.

Insert a new paragraph 12.6., to read

"12.6. Transitional provisions applicable to 07 series of amendments

Contracting Parties applying this Regulation:

From [1 September 2020] (36 months after the date of entry into force) shall grant approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by the 07 series of amendments."

Annex 5, amend to read:

"Annex 5

States of loading to be taken into consideration in determining variations in the vertical orientation of the dipped-beam headlamps

Loading conditions on axles referred to in paragraphs ~~6.2.6.1.~~ **6.2.6.1.1.2., 6.2.6.1.2.2., 6.2.6.2.1.1., 6.2.6.2.1.2., 6.2.6.2.2.2** and 6.2.6.3.1.

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

2. Loading conditions for different types of vehicles:
- 2.1. Vehicles in Category M₁⁽³⁾, **[and, at the discretion of the manufacturer, N₁ derived from M₁]**
- 2.1.1. ~~The angle of the light beam~~ **downward inclination of the cut-off** of the dipped-beam headlamps shall be determined under the following load conditions:
- 2.1.1.1. One person in the driver's seat;
- 2.1.1.2. The driver, plus one passenger in the front seat farthest from the driver;
- 2.1.1.3. 50 per cent loading**
- "50 per cent loading" means 50 - per cent of the difference between the laden and unladen state of the vehicle, as defined respectively in paragraphs 2.5. and 2.4. of this Regulation.**
- The following sequence shall be used in the order proposed below to attain the 50 per cent loading condition:**
- (a) **the driver;**
- (b) **on the front seat furthest from the driver a mass up to 75 kg;**
- (c) **for the row immediately behind the driver's seat, load the two outer seats with a mass up to 75 kg per seat;**
- (d) **where additional load is necessary, it shall be evenly distributed in the luggage / load compartment(s).**
- 2.1.1.4. The driver, one passenger in the front seat farthest from the driver, all the seats farthest to the rear occupied;
- 2.1.1.5. All the seats occupied;
- 2.1.1.6. All the seats occupied, plus an evenly distributed load in the luggage / load, in order to obtain the permissible load on the rear axle or on the front axle if the ~~boot~~ **luggage / load compartment** is at the front. If the vehicle has a front and a rear ~~boot~~ **luggage / load compartment**, the additional load shall 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~~ **luggage / load compartment** (s) shall be limited to the figure which enables that mass to be reached;
- 2.1.1.7. Driver, plus an evenly distributed load in the ~~boot~~ **luggage / load compartment**, 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~~ **luggage / load compartment** (s) shall be limited to the figure which enables that mass to be reached.

⁽³⁾ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3), ECE/TRANS/WP.29/78/Rev.2, para. 2.

- 2.1.2. In determining the above loading conditions, account shall be taken of any loading restrictions laid down by the manufacturer.
- 2.2. Vehicles in Categories M₂ and M₃;⁽³⁾
- The ~~angle of the light beam from~~ **downward inclination of the cut-off** of the dipped-beam headlamps shall be determined under the following loading conditions:
- 2.2.1. Vehicle unladen and one person in the driver's seat;
- 2.2.2. Vehicles laden such that each axle carries its maximum technically permissible load or until the maximum permissible mass of the vehicle is attained by loading the front and rear axles proportionally to their maximum technically permissible loads, whichever occurs first.
- 2.3. Vehicles in Category N ⁽³⁾ [**except, at the discretion of the manufacturer, N₁ derived from M₁**] with load surfaces:
- 2.3.1. The ~~angle of the light beam from~~ **downward inclination of the cut-off** of the dipped-beam headlamps shall be determined under the following loading conditions;
- 2.3.1.1. Vehicle unladen and one person in the driver's seat;
- 2.3.1.2. 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 per cent of the maximum permissible payload on the front axle.
- Conversely, the front axle is so considered when the load surfaces is at the front.
- 2.4. Vehicles in Category N ⁽³⁾ [**except, at the discretion of the manufacturer, N₁ derived from M₁**] without a load surface:
- 2.4.1. Drawing vehicles for semi-trailers:
- 2.4.1.1. Unladen vehicle without a load on the coupling attachment and one person in the driver's seat;
- 2.4.1.2. 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.
- 2.4.2. Drawing vehicles for trailers:
- 2.4.2.1. Vehicle unladen and one person in the driver's seat;
- 2.4.2.2. One person in the driver's seat, all the other places in the driving cabin being occupied."

Annex 6, amend to read:

(3) As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3) document ECE/TRANS/WP.29/78/Rev.3, para. 2.

"Annex 6

Measurement of the variation of dipped-beam inclination as a function of load

1. Scope

This annex specifies a method for measuring variations in motor vehicle dipped-beam inclination, in relation to its initial inclination, caused by changes in vehicle attitude due to loading.

2. Definitions

2.1. Initial inclination

2.1.1. Stated initial inclination

The value of the dipped-beam initial inclination specified by the motor vehicle manufacturer serving as a reference value for the calculation of permissible variations.

2.1.2. Measured initial inclination

The mean value of dipped-beam inclination or vehicle inclination measured with the vehicle in **the first loading** condition ~~No. 1, as defined in Annex 5,~~ for the category of vehicle under test, **as defined in Annex 5 to this Regulation**. It serves as a reference value for the assessment of variations in beam inclination as the load varies.

2.2. Dipped-beam inclination

It may be 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 per cent 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 the above-mentioned characteristic point, measured on a vertical screen perpendicular to the vehicle longitudinal median plane, placed at a horizontal distance L .

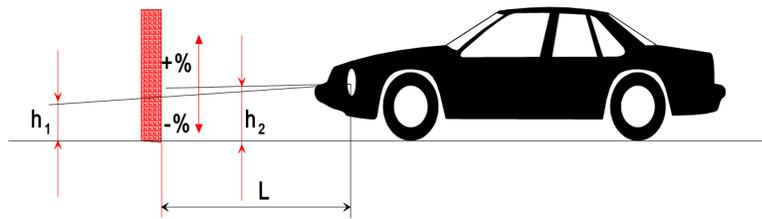
h_2 is the height above the ground, in millimetres, of the centre of reference (which is taken to be the nominal origin of the characteristic point chosen in h_1):

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.

Figure 1

Dipped-beam downward inclination of a category M₁ vehicle

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 levelling system, the variation in dipped-beam inclination is identical with the variation in the inclination of the vehicle itself.
3. Measurement conditions
 - 3.1. If a visual inspection of the dipped-beam pattern on the screen or a photometric method is used, measurement 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.
 - 3.2. 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 per cent inclination).
 - 3.3. 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 per cent inclination).
 - 3.4. During measurements, the ambient temperature shall be between 10 and 30 °C.
4. Vehicle preparation
 - 4.1. 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.
 - 4.2. 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.~~ **Full fuel replenishment means that the fuel tank shall be filled to not less than 90 per cent of its capacity. "unladen" as defined in paragraph 2.4. of this Regulation.**
 - 4.3. The vehicle shall have the parking brake released and the gearbox in neutral.
 - 4.4. The vehicle shall be conditioned for at least 8 h at the temperature specified in paragraph 3.4. above.
 - 4.5. 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).

5. Test procedure

5.1. 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 5, shall be within the limits set out in paragraph 5.5. below. The load shall be applied gradually without subjecting the vehicle to excessive shocks.

5.1.1. Where an AFS is fitted, the measurements shall be carried out with the AFS in its neutral state.

5.2. Determination of the measured initial inclination

The vehicle shall be prepared as specified in paragraph 4. above and laden **to the first loading condition for the category of vehicle under test**, as specified in Annex 5 (~~first loading condition of the respective vehicle category~~) **to this Regulation**. Before each measurement, the vehicle shall be rocked as specified in paragraph 5.4. below. Measurements shall be made three times.

5.2.1. If none of the three measured results differ by more than 2 mrad (0.2 per cent inclination) from the arithmetic mean of the results, that mean shall constitute the final result.

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

5.3. 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 per cent inclination).

5.4. Treatment of vehicle in each loading condition

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

However, the technical authorities 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.

5.4.1. M₁ 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.

- 5.4.2. M₂, M₃ and N category vehicles with conventional suspension
- 5.4.2.1. If the treatment method for category M₁ vehicles described in paragraph 5.4.1. is not possible, the method described in paragraphs 5.4.2.2. or 5.4.2.3. **below** may be used.
- 5.4.2.2. With the vehicle standing on the measuring site and the wheels on the ground, rock the vehicle by temporarily varying the load.
- 5.4.2.3. 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.
- 5.4.3. Vehicles with non-conventional suspension, where the engine has to be running.
- Before making any measurement wait until the vehicle has assumed its final attitude with the engine running.
- 5.5. Measurements
- The variation of the inclination of the dipped-beam shall be assessed for each of the different loading conditions **as specified in Annex 5 to this Regulation**, in relation to the measured initial inclination determined in accordance with paragraph 5.2. 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 5 **to this Regulation**).
- 5.5.1. 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 per cent inclination).
- 5.5.2. If the result(s) of any measurement(s) does (do) not lie within the safety margin indicated in paragraph 5.5.1. **above** 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 paragraph 5.5.3. **below**.
- 5.5.3. For each of the above loading conditions:
- 5.5.3.1. If none of the three measured results differs by more than 2 mrad (0.2 per cent inclination) from the arithmetic mean of the results, that mean shall constitute the final result.
- 5.5.3.2. If any measurement differs from the arithmetic mean of the results by more than 2 mrad (0.2 per cent inclination), a further series of 10 measurements shall be made, the arithmetic mean of which shall constitute the final result.
- 5.5.3.3. If a vehicle is fitted 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 paragraphs 5.5.3.1. and 5.5.3.2. **above**.

"Annex 8

The controls for the headlamp-levelling devices referred to in paragraphs 6.2.6.2.2., 6.2.6.2.1.2. and 6.2.6.2.2.2. of this Regulation

1. SPECIFICATIONS

1.1. Downward inclination of the dipped-beam shall in all cases be produced in one of the following ways:

- (a) By moving a control downwards or to the left;
- (b) By rotating a control in a counter clockwise direction;
- (c) By depressing a button (push-pull control).

If several buttons are used to adjust the beam, the button which gives the greatest downward inclination shall be installed to the left or below the button(s) for other dipped-beam positions.

A rotary control which is installed edge-on, or with only the edge visible, should follow the operating principles of control of Types (a) or (c)

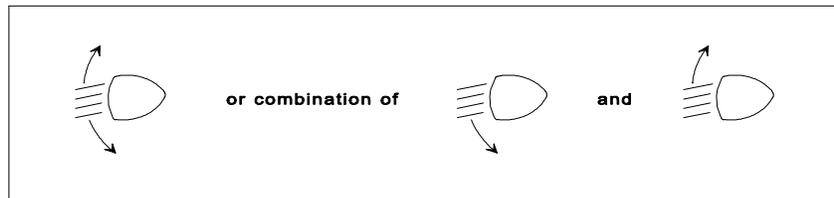
1.1.1. This control shall carry symbols indicating clearly the movements corresponding to the downward and upward inclination of the dipped-beam.

1.2. The "0" position corresponds to the initial inclination according to paragraphs ~~6.2.6.1.1.~~ **6.2.6.1.1.1.** and **6.2.6.2.1.1.** of this Regulation.

1.3. The "0" position which, according to paragraph ~~6.2.6.2.2.~~ **6.2.6.2.2.2.** of this Regulation has to be a "stop position", need not necessarily be at the end of the scale.

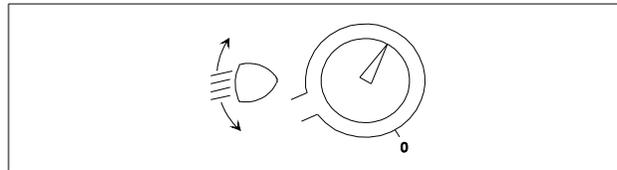
1.4. The marks used on control shall be explained in the owner's handbook.

1.5. Only the following symbols may be used to identify the controls:

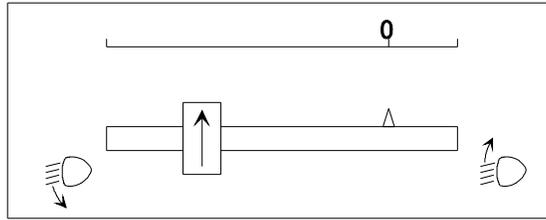


Symbols employing five lines instead of four may also be used

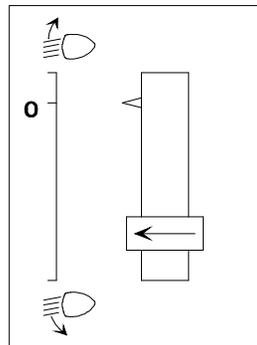
Example 1



Example 2



Example 3



Note: Symbols employing five lines instead of four may also be used."

Annex 9, paragraphs 1.3.1. , 1.3.2. and 1.3.1.2., amend to read:

"1.3.1. Initial downward inclination

The initial downward inclination of the cut-off of the dipped-beam, **as prescribed in paragraph 6.2.6.1.1.1.** and the class "F3" front fog lamps, **as prescribed in paragraph 6.3.6.1.2.1.1.**, shall be set to the plated figure as required and shown in Annex 7 **to this Regulation.**

Alternatively the manufacturer shall set the initial aim to a figure that is different from the plated figure where it can be shown to be representative of the type approved when tested in accordance with the procedures contained in Annex 6 **to this Regulation** and in particular paragraph 4.1.

1.3.2. Variation of inclination with load

For vehicles in M₁ category, [and, at the discretion of the manufacturer, N₁ derived from M₁] the variation of the dipped-beam downward inclination as a function of the loading conditions specified within this section shall remain within the range prescribed in paragraph 6.2.6.1.1.2.

For vehicles in categories M and N other than M₁ [and, at the discretion of the manufacturer, N₁ derived from M₁], the variation of the dipped-beam downward inclination as a function of the loading conditions specified within this section shall remain within the range:

0.2 per cent to 2.8 per cent for headlamp mounting height $h < 0.8$;

0.2 per cent to 2.8 per cent for headlamp mounting height $0.8 \leq h \leq 1.0$; or

0.7 per cent to 3.3 per cent (according to the aiming range chosen by the manufacturer at the approval);

0.7 per cent to 3.3 per cent for headlamp mounting height $1.0 < h \leq 1.2$ m;

1.2 per cent to 3.8 per cent for headlamp mounting height $h > 1.2$ m.

For all the categories of vehicles, in the case of a class "F3" front fog lamp with (a) light source(s) having a total objective luminous flux which exceeds 2,000 lumens, the variation of the downward inclination as a function of the loading conditions specified within this section shall remain within the range:

0.7 per cent to 3.3 per cent for front fog lamp mounting height $h \leq 0.8$;

1.2 per cent to 3.8 per cent for front fog lamp mounting height $h > 0.8$ m.

The ~~states of loading conditions defined in Annex 5 to this Regulation to be used shall be as follows, as indicated in Annex 5 of this Regulation, the following:~~ **following:** ~~[for every system adjusted accordingly].~~

1.3.2.1. Vehicles in category M₁:

Paragraph 2.1.1.1.

Paragraph 2.1.1-~~6~~ 7, taking into account Paragraph 2.1.2."

II. Justification

1. The following explanation summarises the major steps undertaken by GTB and OICA that have culminated in this proposal for amendment to Regulation No. 48. An informal document for the seventy-third session of GRE will provide further detailed supportive information.

2. This document has been prepared to formally introduce the joint GTB / OICA proposal to amend Regulation No. 48. However, it is anticipated that the discussion at the seventy-third session of GRE will result in the need for a further submission, hopefully resulting in adoption at the seventy-fourth session. A final decision at the seventy-third session of GRE is not being sought.

3. At its sixty-fourth session, GRE considered the informal proposal (GRE-64-57) by the expert from Germany to mandate automatic levelling for all headlamps producing a principal dipped beam. The experts from Germany and the Netherlands resubmitted this proposal at the sixty-fifth session (ECE/TRANS/WP.29/GRE/2011/27). The proposal received comments from the experts of GTB (GRE-65-03 and GRE-65-17) and OICA (GRE-65-16) among others.

4. At the sixty-fifth session of GRE, GTB presented an initial response (GRE-65-17) and concluded that:

- There is no evidence that glare causes road accidents. However, it does provoke complaints.
- There is strong evidence that good road illumination produced by efficient headlamps reduces accidents.
- The 2,000 lm criterion cannot be justified on safety grounds and it incorrectly distinguishes between light source technologies.
- The benefit for road-safety is only limited, which would justify the additional costs, from the mandatory installation of auto-levelling.
- A detailed study of the relationship of headlamp alignment and glare in the real-world road traffic conditions was required. The work of International Commission on Illumination (CIE) technical committee TC4-45 and the Society of Automotive

Engineers (SAE) Pedestrian Visibility Taskforce provided a good basis for glare / visibility investigations.

5. GRE adopted ECE/TRANS/WP.29/GRE/2011/27 with the addition of a 90-month transitional provision and agreed that:

- This adoption was subject to the development of a proposal, to be prepared by the expert from GTB who would lead a comprehensive study on glare and visibility during night-time driving.
- In case the results of the study revealed alternatives to the adopted mandatory requirements for automatic levelling and cleaning, the provisions of Regulation No. 48 would be re-examined at any time during the 90-month transitional period provided by ECE/TRANS/WP.29/GRE/2011/27.
- A dedicated working group based on the GTB structure would manage the study, and participation would be open to GRE experts.

6. GTB launched its task force for the **Coordination of Automotive Visibility and Glare Studies (CAVGS)** in June 2011. The task force documents are available with unrestricted access on the GTB website (www.gtb-lighting.org/VGS/indexVGS.htm).

7. At its June 2012 session, WP.29 decided to refer documents ECE/TRANS/WP.29/2011/99 and Corr.1 back to GRE for further consideration. In this respect, the EU requested a cost/benefit analysis.

8. The GTB CAVGS task force presented the results of these studies to GRE at its seventy-first session (GRE-71-32) with conclusions that:

- Vehicle inclination (pitch angle) and the mounting height of headlamps controls visibility distance and glare.
- Analysis based upon the CIE Standard CIE S021/E: 2011 and the Technical Report CIE188: 2010 clearly demonstrated that there is no correlation between glare and the type of light source (GRE-71-32, page 50). The existing 2,000 lumen criterion is not appropriate.

9. GTB addressed the levelling issue at the sixty-fifth session of GRE (GRE-65-17) arguing that, based upon the available evidence, the vehicle-loading effects only contribute to 22 per cent of the influencing factors of glare. Further, GRE-65-17 summarised the results of accident studies indicating that the conditions under which static auto-levelling would contribute to road safety (GRE-65-17, pages 19-22). This led to the decision to carry out a series of tests with M₁ vehicles at the DEKRA test centre in Klettwitz, Germany to evaluate the effects of different headlamp technologies and vehicle installations on glare, based on a "50 per cent loading condition". An overview of the preparation, execution and subsequent work associated with the Klettwitz tests was presented (GRE-71-32, pages 79-98, 102-116 and 154-158).

10. The conclusion of the Klettwitz tests was that the deciding factors concerning headlamp glare are vehicle pitch angle resulting from loading conditions and initial headlamp aim in association with mounting height. The type of light source has no influence on the results. Glare is independent of the type of light source. Based upon these conclusions, GTB recommended the replacement of the 2,000 lm criterion as the determining requirement for automatic levelling.

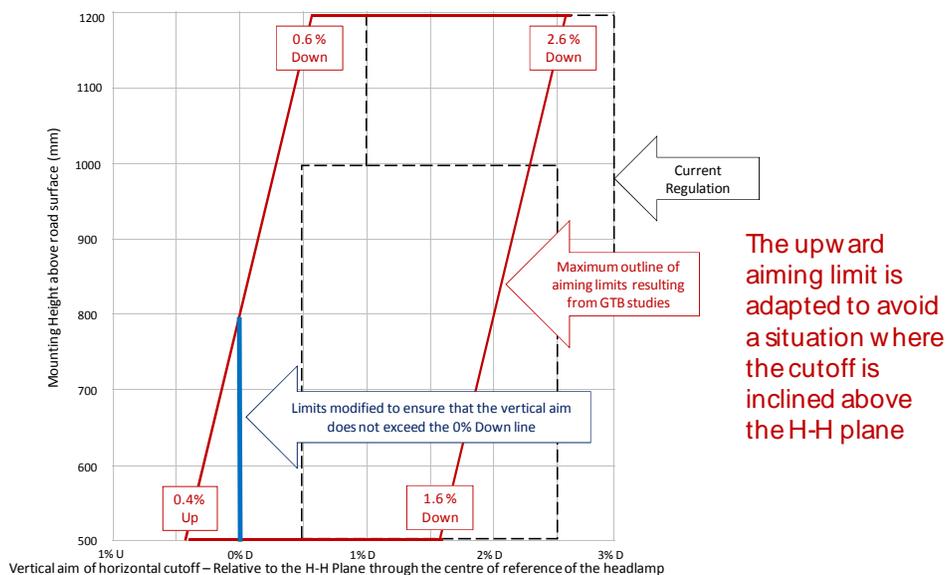
11. The Klettwitz tests focused on the issue of glare toward oncoming drivers and provided clear indications on glare effects using a selection of vehicles set up with initial aiming of the headlamps at 1 per cent down and with "50 per cent loading". GTB

demonstrated the correlation between the Klettwitz test results and the research summarised in a literature review (GRE-71-32, pages 102-116).

12. In addition to the question of glare, the expert from Poland emphasised the importance of maintaining adequate visibility distance. GTB concluded that it was necessary to extend the scope of its study to define an acceptable range of headlamp aim that would respect both glare and visibility concerns. Consequently, GTB decided to carry out a series of calculations following the CIE Standard S021/E: 2011 (GRE-71-32, pages 118-152).

13. The presentation of the work of the GTB CAVGS task force to the seventy-first session of GRE concluded with a diagram showing the absolute aiming limits, resulting from the CIE calculations, to respect glare and visibility considerations for a range of headlamp mounting heights. Discussion at the seventy-first session of GRE revealed concerns of the contracting parties related to the aiming of the cut-off above the H-H line (above 0 per cent D) in the case of the lower mounting heights. The diagram was amended to take account of these concerns as follows:

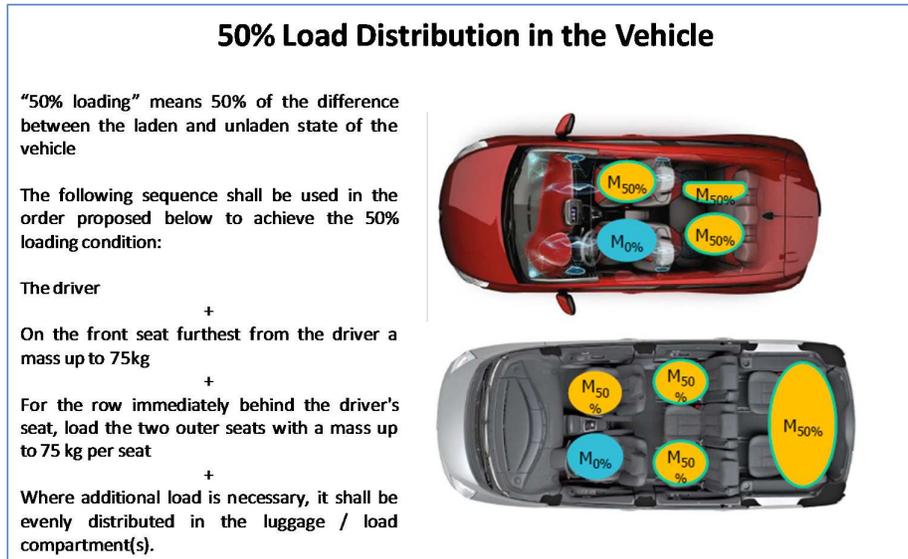
Figure No. 1
Aiming limits and headlamp mounting heights



14. In conclusion, the joint GTB / OICA proposal is to introduce a criterion to determine in which cases automatic static headlamp levelling shall be installed. This criterion is based upon the pitch of the vehicle resulting from the 50 per cent load distribution shown below. This replaces the existing 2,000 lumen criterion and so introduces a performance-based requirement instead of the current design restrictive requirement.

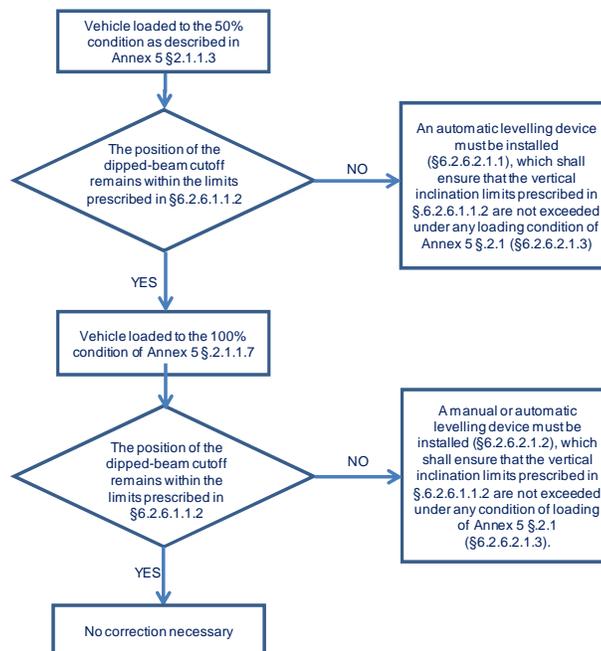
15. It is important to note that the "50 per cent loading" condition is in addition to the current loading conditions described in Annex 5 to Regulation No. 48.

Figure No. 2
50 per cent loading



16. In the case where the application of the "50 per cent loading" criterion does not indicate mandatory automatic static headlamp levelling and the requirements of the "100 per cent loading" are not fulfilled, a manual or automatic levelling device shall be installed (please refer to the flow diagram below).

Figure No. 3
Flowchart for levelling



17. It should be emphasised that the initial aiming requirement remains but the vehicle manufacturer declares the actual value during the type approval.
