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Contents

I *Acts adopted under the EC Treaty/Euratom Treaty whose publication is obligatory*

REGULATIONS

★ **Regulation No 48 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of vehicles with regard to the installation of lighting and light-signalling devices** 1

★ **Regulation No 51 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of motor vehicles having at least four wheels with regard to their noise emissions** 68

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Acts whose titles are printed in light type are those relating to day-to-day management of agricultural matters, and are generally valid for a limited period.

The titles of all other acts are printed in bold type and preceded by an asterisk.

I

(Acts adopted under the EC Treaty/Euratom Treaty whose publication is obligatory)

REGULATIONS

Regulation No 48 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of vehicles with regard to the installation of lighting and light-signalling devices

Addendum 47: Regulation No 48

Revision 4 (including Amendment 1)

Incorporating all valid text up to:

03 series of amendments — Date of entry into force: 10 October 2006

CONTENTS

REGULATION

1. Scope
2. Definitions
3. Application for approval
4. Approval
5. General specifications
6. Individual specifications
7. Modifications and extensions of the approval of the vehicle type or of the installation of its lighting and light-signalling devices
8. Conformity of production
9. Penalties for non-conformity of production
10. Production definitely discontinued
11. Names and addresses of the Technical Services responsible for conducting approval tests, and of Administrative Departments
12. Transitional provisions

ANNEXES

Annex 1 Communication concerning the approval or refusal or extension or withdrawal of approval or production definitely discontinued of a vehicle type with regard to the installation of lighting and light signalling devices, pursuant to Regulation No 48

Annex 2 Arrangements of approval marks

Annex 3 Lamp surfaces, axis and centre of reference, and angles of geometric visibility

Annex 4 Visibility of a red lamp to the front and visibility of a white lamp to the rear

Annex 5 States of loading to be taken into consideration in determining variations in the vertical orientation of the dipped-beam headlamp

Annex 6 Measurement of the variation of dipped-beam inclination as a function of load

Annex 7 Indication of the stated initial adjustment referred to in paragraph 6.2.6.1.1 of this Regulation

Annex 8 The controls for the headlamp levelling devices referred to in paragraph 6.2.6.2.2 of this Regulation

Annex 9 Control of conformity of production

Annex 10 Examples of light source options

Annex 11 Visibility of conspicuity markings to the rear and side of a vehicle

1. SCOPE

This Regulation applies to the approval of power-driven vehicles intended for use on the road, with or without bodywork, with not less than four wheels and a maximum design speed exceeding 25 km/h, and of their trailers, with the exception of vehicles which run on rails, agricultural or forestry tractors and machinery, and public works vehicles.

2. DEFINITIONS

For the purpose of this Regulation:

2.1. 'Approval of a vehicle' means the approval of a vehicle type with regard to the number and mode of installation of the lighting and light-signalling devices.

2.2. 'Vehicle type with regard to the installation of lighting and light-signalling devices' means vehicles which do not differ in the essential respects mentioned in paragraphs 2.2.1 to 2.2.4.

The following are likewise considered not to be 'vehicles of a different type': vehicles which differ within the meaning of paragraphs 2.2.1. to 2.2.4., but not in such a way as to entail a change in the kind, number, positioning and geometric visibility of the lamps and the inclination of the dipped-beam prescribed for the vehicle type in question, and vehicles on which optional lamps are fitted or are absent:

2.2.1. the dimension and the external shape of the vehicle;

2.2.2. the number and positioning of the devices;

2.2.3. the headlamp-levelling system;

2.2.4. the suspension system.

2.3. 'Transverse plane' means a vertical plane perpendicular to the median longitudinal plane of the vehicle;

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;

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

2.6. 'Device' means an element or an assembly of elements used to perform one or more functions;

2.7. 'Lamp' means a device designed to illuminate the road or to emit a light signal to other road users. Rear registration plate lamps and retro-reflectors are likewise to be regarded as lamps. For the purpose of this Regulation, light-emitting rear registration plates and the service-door-lighting system according to the provisions of Regulation No 107 on vehicles of categories M_2 and M_3 are not considered as lamps;

2.7.1. Light source (*)

2.7.1.1. 'Light source' means one or more elements for visible radiation, which may be assembled with one or more transparent envelopes and with a base for mechanical and electrical connection.

A light source may also be constituted by the extreme outlet of a light-guide, as part of a distributed lighting or light-signalling system not having a built-in outer lens;

2.7.1.1.1. 'Replaceable light source' means a light source which is designed to be inserted in and removed from the holder of its device without tool;

2.7.1.1.2. 'Non-replaceable light source' means a light source which can only be replaced by replacement of the device to which this light source is fixed;

in case of a light source module: a light source which can only be replaced by replacement of the light source module to which this light source is fixed;

2.7.1.1.3. 'Light source module' means an optical part of a device which is specific to that device, is containing one or more non-replaceable light sources, and is only removable from its device with the use of tool(s). A light source module is so designed that regardless the use of tool(s), it is not mechanically interchangeable with any replaceable approved light source;

2.7.1.1.4. 'Filament light source' (filament lamp) means a light source where the element for visible radiation is one or more heated filaments producing thermal radiation;

2.7.1.1.5. 'Gas-discharge light source' means a light source where the element for visible radiation is a discharge arc producing electro-luminescence/fluorescence;

2.7.1.1.6. 'Light-emitting diode' (LED) means a light source where the element for visible radiation is one or more solid state junctions producing injection-luminescence/fluorescence;

2.7.1.2. 'Electronic light source control gear' means one or more components between supply and light source to control voltage and/or electrical current of the light source;

2.7.1.2.1. 'Ballast' means an electronic light source control gear between supply and light source to stabilise the electrical current of a gas-discharge light source;

2.7.1.2.2. 'Ignitor' means an electronic light source control gear to start the arc of a gas-discharge light source.

2.7.2. 'Equivalent lamps' means lamps having the same function and authorised in the country in which the vehicle is registered; such lamps may have different characteristics from those installed on the vehicle when it is approved on condition that they satisfy the requirements of this Regulation;

2.7.3. 'Independent lamps' means devices having separate illuminating surfaces [1], separate light sources and separate lamp bodies;

2.7.4. 'Grouped lamps' means devices having separate illuminating surfaces [1] and separate light sources, but a common lamp body;

2.7.5. 'Combined lamps' means devices having separate illuminating surfaces [1], but a common light source and a common lamp body;

(*) For clarification see Annex 10.

[1] In the case of lighting devices for the rear registration plate and the direction-indicators (categories 5 and 6), replace by 'light-emitting surface' in the absence of an illuminating surface.

2.7.6. 'Reciprocally incorporated lamps' means devices having separate light sources or a single light source operating under different conditions (for example, optical, mechanical, electrical differences), totally or partially common illuminating surfaces [1] and a common lamp body;

2.7.7. 'Single-function lamp' means a part of a device which performs a single lighting or light-signalling function;

2.7.8. 'Concealable lamp' means a lamp capable of being partly or completely hidden when not in use. This result may be achieved by means of a 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 the displacement of which enables it to be inserted within the bodywork;

2.7.9. 'Driving beam (main-beam) headlamp' means the lamp used to illuminate the road over a long distance ahead of the vehicle;

2.7.10. 'Passing beam (dipped-beam) headlamp' means the lamp used to illuminate the road ahead of the vehicle without causing undue dazzle or discomfort to oncoming drivers and other road-users;

2.7.11. 'Direction-indicator lamp' means the lamp used to indicate to other road-users that the driver intends to change direction to the right or to the left;

A direction-indicator lamp or lamps may also be used according to the provisions of Regulation No 97;

2.7.12. 'Stop lamp' means a lamp used to indicate to other road users to the rear of the vehicle that the longitudinal movement of the vehicle is intentionally retarded;

2.7.13. 'Rear-registration plate illuminating device' means the device used to illuminate the space reserved for the rear registration plate; such a device may consist of several optical components;

2.7.14. 'Front position lamp' means the lamp used to indicate the presence and the width of the vehicle when viewed from the front;

2.7.15. 'Rear position lamp' means the lamp used to indicate the presence and width of the vehicle when viewed from the rear;

2.7.16. 'Retro-reflector' means a device used to indicate the presence of a vehicle by the reflection of light emanating from a light source not connected to the vehicle, the observer being situated near the source.

For the purposes of this Regulation the following are not considered as retro-reflectors:

2.7.16.1. retro-reflecting number plates;

2.7.16.2. the retro-reflecting signals mentioned in the ADR (European Agreement concerning the international carriage of dangerous goods by road);

2.7.16.3. other retro-reflective plates and signals which must be used to comply with national requirements for use as regards certain categories of vehicles or certain methods of operation;

2.7.16.4. retro-reflecting materials approved as Class D or E according to Regulation No 104 and used for other purposes in compliance with national requirements, e.g. advertising.

[1] In the case of lighting devices for the rear registration plate and the direction-indicators (categories 5 and 6), replace by 'light-emitting surface' in the absence of an illuminating surface.

2.7.17. 'Conspicuity marking' means a device intended to increase the conspicuity of a vehicle, when viewed from the side or rear, by the reflection of light emanating from a light source not connected to the vehicle, the observer being situated near the source;

2.7.17.1. 'Contour marking' means a conspicuity marking intended to indicate the horizontal and vertical dimensions (length, width and height) of a vehicle;

2.7.17.1.1. 'Full contour marking' means a contour marking that indicates the outline of the vehicle by a continuous line;

2.7.17.1.2. 'Partial contour marking' means a contour marking that indicates the horizontal dimension of the vehicle by a continuous line, and the vertical dimension by marking the upper corners.

2.7.17.2. 'Line marking' means a conspicuity marking intended to indicate the horizontal dimensions (length and width) of a vehicle by a continuous line.

2.7.18. 'Hazard warning signal' means the simultaneous operation of all of a vehicle's direction-indicator lamps to show that the vehicle temporarily constitutes a special danger to other road-users;

2.7.19. 'Front fog lamp' means the lamp used to improve the illumination of the road in case of fog, snowfall, rainstorms or dust clouds;

2.7.20. 'Rear fog lamp' means a lamp used to make the vehicle more easily visible from the rear in dense fog;

2.7.21. 'Reversing lamp' means the lamp used to illuminate the road to the rear of the vehicle and to warn other road-users that the vehicle is reversing or about to reverse;

2.7.22. 'Parking lamp' means a lamp which is used to draw attention to the presence of a stationary vehicle in a built-up area. In such circumstances it replaces the front and rear position lamps;

2.7.23. 'End-outline marker lamp' means the lamp fitted near to the extreme outer edge and as close as possible to the top of the vehicle and intended to indicate clearly the vehicle's overall width. This lamp is intended, for certain vehicles and trailers, to complement the vehicle's front and rear position lamps by drawing particular attention to its bulk;

2.7.24. 'Side marker lamp' means a lamp used to indicate the presence of the vehicle when viewed from the side;

2.7.25. 'Daytime running lamp' means a lamp facing in a forward direction used to make the vehicle more easily visible when driving during daytime [1];

2.7.26. 'Cornering lamp' means a lamp used to provide supplementary illumination of that part of the road which is located near the forward corner of the vehicle at the side towards which the vehicle is going to turn;

2.7.27. 'Objective luminous flux' means a design value of the luminous flux of a replaceable light source. It shall be achieved, within the specified tolerances, when the replaceable light source is energised by the power supply at the specified test voltage, as indicated in the data sheet of the light source;

2.8. 'Light emitting surface' of a 'lighting device', 'light-signalling device' or a retro-reflector means all or part of the exterior surface of the transparent material as declared in the request for approval by the manufacturer of the device on the drawing, see Annex 3;

[1] National requirements may permit the use of other devices to meet this function.

2.9. 'Illuminating surface' (see Annex 3);

2.9.1. 'Illuminating surface of a lighting device' (paragraphs 2.7.9, 2.7.10, 2.7.19, 2.7.21 and 2.7.26) means the orthogonal projection of the full aperture of the reflector, or in the case of headlamps with an ellipsoidal reflector of the 'projection lens', on a transverse plane. If the lighting device has no reflector, the definition of paragraph 2.9.2 shall be applied. If the light emitting surface of the lamp extends over part only of the full aperture of the reflector, then the projection of that part only is taken into account.

In the case of a dipped-beam headlamp, the illuminating surface is limited by the apparent trace of the cut-off on to the lens. If the reflector and lens are adjustable relative to one another, the mean adjustment should be used;

2.9.2. 'Illuminating surface of a light-signalling device other than a retro-reflector' (paragraphs 2.7.11 to 2.7.15, 2.7.18, 2.7.20 and 2.7.22 to 2.7.25) means the orthogonal projection of the lamp in a plane perpendicular to its axis of reference and in contact with the exterior light-emitting surface of the lamp, this projection being bounded by the edges of screens situated in this plane, each allowing only 98 % of the total luminous intensity of the light to persist in the direction of the axis of reference.

To determine the lower, upper and lateral limits of the illuminating surface only screens with horizontal or vertical edges shall be used to verify the distance to the extreme edges of the vehicle and the height above the ground.

For other applications of the illuminating surface, e.g. distance between two lamps or functions, the shape of the periphery of this illuminating surface shall be used. The screens shall remain parallel, but other orientations are allowed to be used.

In the case of a light-signalling device whose illuminating surface encloses either totally or partially the illuminating surface of another function or encloses a non-lighted surface, the illuminating surface may be considered to be the light emitting surface itself.

2.9.3. 'Illuminating surface of a retro-reflector' (paragraph 2.7.16) means, as declared by the applicant during the component approval procedure for the retro-reflectors, the orthogonal projection of a retro-reflector in a plane perpendicular to its axis of reference and delimited by planes contiguous to the declared outermost parts of the retro-reflectors' optical system and parallel to that axis. For the purposes of determining the lower, upper and lateral edges of the device, only horizontal and vertical planes shall be considered.

2.10. The 'apparent surface' for a defined direction of observation means, at the request of the manufacturer or his duly accredited representative, the orthogonal projection of:

either the boundary of the illuminating surface projected on the exterior surface of the lens (a-b);

or the light-emitting surface (c-d);

in a plane perpendicular to the direction of observation and tangential to the most exterior point of the lens (see Annex 3 to this Regulation).

2.11. 'Axis of reference' (or 'reference axis') means the characteristic axis of the lamp determined by the manufacturer (of the lamp) for use as the direction of reference (H = 0°, V = 0°) for angles of field for photometric measurements and for installing the lamp on the vehicle;

2.12. 'Centre of reference' means the intersection of the axis of reference with the exterior light-emitting surface; it is specified by the manufacturer of the lamp;

2.13. 'Angles of geometric visibility' means the angles which determine the field of the minimum solid angle in which the apparent surface of the lamp must be visible. That field of the solid angle is determined by the segments of the sphere of which the centre coincides with the centre of reference of the lamp and the equator is parallel with the ground. These segments are determined in relation to the axis of reference. The horizontal angles ß correspond to the longitude and the vertical angles α to the latitude. There must be no obstacle on the inside of the angles of geometric visibility to the propagation 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 shifted 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 presented when the lamp was type-approved.

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 furnished that the part of the lamp not hidden by obstacles still conforms to the photometric values prescribed for the approval of the device as an optical unit (see Annex 3 of this Regulation). Nevertheless, when the vertical angle of geometric visibility below the horizontal may be reduced to 5° (lamp at less than 750 mm above the ground) the photometric field of measurements of the installed optical unit may be reduced to 5° below the horizontal.

2.14. 'Extreme outer edge' on either side of the vehicle, means the plane parallel to the median longitudinal plane of the vehicle and touching its lateral outer edge, disregarding the projection:

2.14.1. of tyres near their point of contact with the ground, and of connections for tyre-pressure gauges;

2.14.2. of any anti-skid devices mounted on the wheels;

2.14.3. of rear-view mirrors;

2.14.4. of side direction-indicator lamps, end-outline marker lamps, front and rear position lamps, parking lamps, retro-reflectors and side-marker lamps;

2.14.5. of customs seals affixed to the vehicle, and of devices for securing and protecting such seals.

2.15. 'Overall width' means the distance between the two vertical planes defined in paragraph 2.14. above;

2.16. 'Single and multiple lamps'

2.16.1. 'A single lamp' means:

(a) a device or part of a device having one lighting or light-signalling function, one or more light source(s) and one apparent surface in the direction of the reference axis, which may be a continuous surface or composed of two or more distinct parts, or

(b) any assembly of two independent lamps, whether identical or not, having the same function, both approved as type 'D' lamp and installed so that the projection of their apparent surfaces in the direction of the reference axis occupies not less than 60 % of the smallest quadrilateral circumscribing the projections of the said apparent surfaces in the direction of the reference axis.

2.16.2. 'Two lamps' or 'an even number of lamps', means a single light-emitting surface in the shape of a band or strip if such band or strip is placed symmetrically in relation to the median longitudinal plane of the vehicle, extends on both sides to within at least 0,4 m of the extreme outer edge of the vehicle, and is not less than 0,8 m long; the illumination of such surface shall be provided by not less than two light sources placed as close as possible to its ends; the light-emitting surface may be constituted by a number of juxtaposed elements on condition that the projections of the several individual light-emitting surfaces on a transverse plane occupy not less than 60 % of the area of the smallest rectangle circumscribing the projections of the said individual light-emitting surfaces;

2.17. 'Distance between two lamps' which face in the same direction means the shortest distance between the two apparent surfaces in the direction of the reference axis. Where the distance between the lamps clearly meets the requirements of the Regulation, the exact edges of apparent surfaces need not be determined;

2.18. 'Operating tell-tale' means a visual or auditory signal (or any equivalent signal) indicating that a device has been switched on and is operating correctly or not;

2.19. 'Closed-circuit tell-tale' means a visual (or any equivalent signal) indicating that a device has been switched on, but not indicating whether it is operating correctly or not;

2.20. 'Optional lamp' means a lamp, the installation of which is left to the discretion of the manufacturer;

2.21. 'Ground' means the surface on which the vehicle stands which should be substantially horizontal;

2.22. 'Movable components' of the vehicle mean those body panels or other vehicle parts the position(s) of which can be changed by tilting, rotating or sliding without the use of tools. They do not include tiltable driver cabs of trucks;

2.23. 'Normal position of use of a movable component' means the position(s) of a movable component specified by the vehicle manufacturer for the normal condition of use and the park condition of the vehicle;

2.24. 'Normal condition of use of a vehicle' means:

2.24.1. for a motor vehicle, when the vehicle is ready to move with its propulsion engine running and its movable components in the normal position(s) as defined in paragraph 2.23;

2.24.2. and for a trailer, when the trailer is connected to a drawing motor vehicle in the conditions as prescribed in paragraph 2.24.1 and its movable components are in the normal position(s) as defined in paragraph 2.23.

2.25. 'Park condition of a vehicle' means:

2.25.1. for a motor vehicle, when the vehicle is at standstill and its propulsion engine is not running and its movable components are in the normal position(s) as defined in paragraph 2.23;

2.25.2. and for a trailer, when the trailer is connected to a drawing motor vehicle in the condition as described in paragraph 2.25.1 and its movable components are in the normal position(s) as defined in paragraph 2.23.

2.26. 'Bend lighting' means a lighting function to provide enhanced illumination in bends.

3. APPLICATION FOR APPROVAL

3.1. The application for approval of a vehicle type with regard to the installation of its lighting and light-signalling devices shall be submitted by the manufacturer or his duly accredited representative.

3.2. It shall be accompanied by the following documents and particulars in triplicate:

3.2.1. a description of the vehicle type with regard to the items mentioned in paragraphs 2.2.1 to 2.2.4, together with the restrictions on loading, particularly the maximum permissible load in the boot;

3.2.2. a list of the devices prescribed by the manufacturer for the lighting and light-signalling assembly. The list may include several types of device for each operation. Each type must be duly identified (component, type-approval mark, name of manufacturer, etc.), in addition the list may include in respect of each function the additional annotation 'or equivalent devices';

3.2.3. a layout drawing of the lighting and light-signalling equipment as a whole, showing the position of the various devices on the vehicle;

3.2.4. if necessary, in order to verify the conformity to the prescriptions of the present Regulation, layout drawing(s) for each individual lamp showing the illuminating surface as defined in paragraph 2.9, the light-emitting surface as defined in paragraph 2.8, the axis of reference as defined in paragraph 2.11 and the centre of reference as defined in paragraph 2.12. This information is not necessary in the case of the rear registration plate lamp (paragraph 2.7.13);

3.2.5. the application shall include a statement of the method used for the definition of the apparent surface (see paragraph 2.10).

3.3. An unladen vehicle fitted with a complete set of lighting and light-signalling equipment, as prescribed in paragraph 3.2.2, and representative of the vehicle type to be approved shall be submitted to the Technical Service responsible for conducting approval tests.

3.4. The document provided in Annex 1 of this Regulation shall be attached to the type-approval documentation.

4. APPROVAL

4.1. If the vehicle type submitted for approval pursuant to this Regulation meets the requirements of the Regulation in respect of all the devices specified in the list, approval of that vehicle type shall be granted.

4.2. An approval number shall be assigned to each type approved. Its first two digits (at present 03, corresponding to the 03 series of amendments) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party shall not assign this number to another vehicle type or to the same vehicle type submitted with equipment not specified in the list referred to in paragraph 3.2.2, subject to the provisions of paragraph 7 of this Regulation.

4.3. Notice of approval or of extension or refusal of approval or production definitely discontinued of a vehicle type/part pursuant to this Regulation shall be communicated to the Parties to the 1958 Agreement applying this Regulation, by means of a form conforming to the model in Annex 1 to this Regulation.

4.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation, an international approval mark consisting of:

4.4.1. A circle surrounding the letter 'E' followed by the distinguishing number of the country which has granted approval ([1]);

4.4.2. The number of this Regulation, followed by the letter 'R', a dash and the approval number to the right of the circle prescribed in paragraph 4.4.1.

4.5. If the vehicle conforms to a vehicle type approved, under one or more other Regulations annexed to the Agreement, in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 4.4.1 need not to be repeated, in such a case the Regulation and approval numbers and the additional symbols of all the Regulations under which approval has been granted in the country which has granted approval under this Regulation shall be placed in vertical columns to the right of the symbol prescribed in paragraph 4.4.1.

4.6. The approval mark shall be clearly legible and be indelible.

4.7. The approval mark shall be placed close to or on the vehicle data plate affixed by the manufacturer.

4.8. Annex 2 to this Regulation gives examples of arrangements of approval marks.

5. GENERAL SPECIFICATIONS

5.1. The lighting and light-signalling devices shall be so fitted that under normal conditions of use as defined in paragraphs 2.24, 2.24.1 and 2.24.2 and notwithstanding any vibrations to which they may be subjected, they retain the characteristics prescribed by this Regulation and enable the vehicle to comply with the requirements of this Regulation. In particular, it shall not be possible for the lamps to be inadvertently maladjusted.

5.2. The illuminating lamps described in paragraphs 2.7.9, 2.7.10 and 2.7.19 shall be so installed that correct adjustment of their orientation can easily be carried out.

5.3. For all light-signalling devices, including those mounted on the side panels, the reference axis of the lamp when fitted to the vehicle must be parallel to the bearing plane of the vehicle on the road; in addition it must be perpendicular to the median longitudinal plane of the vehicle in the case of side retro-reflectors and of side-marker lamps and parallel to that plane in the case of all other signalling devices. In each direction a tolerance of ± 3° shall be allowed. In addition, any specific instructions as regards fitting laid down by the manufacturer must be complied with.

5.4. In the absence of specific instructions, the height and orientation of the lamps shall be verified with the vehicle unladen and placed on a flat, horizontal surface in the condition defined in paragraphs 2.24, 2.24.1 and 2.24.2.

([1]) 1 for Germany, 2 for France, 3 for Italy, 4 for the Netherlands, 5 for Sweden, 6 for Belgium, 7 for Hungary, 8 for the Czech Republic, 9 for Spain, 10 for Serbia and Montenegro, 11 for the United Kingdom, 12 for Austria, 13 for Luxembourg, 14 for Switzerland, 15 (vacant), 16 for Norway, 17 for Finland, 18 for Denmark, 19 for Romania, 20 for Poland, 21 for Portugal, 22 for the Russian Federation, 23 for Greece, 24 for Ireland, 25 for Croatia, 26 for Slovenia, 27 for Slovakia, 28 for Belarus, 29 for Estonia, 30 (vacant), 31 for Bosnia and Herzegovina, 32 for Latvia, 33 (vacant), 34 for Bulgaria, 35 (vacant), 36 for Lithuania, 37 for Turkey, 38 (vacant), 39 for Azerbaijan, 40 for the former Yugoslav Republic of Macedonia, 41 (vacant), 42 for the European Community (Approvals are granted by its Member States using their respective ECE symbol), 43 for Japan, 44 (vacant), 45 for Australia, 46 for Ukraine, 47 for South Africa, 48 for New Zealand, 49 for Cyprus, 50 for Malta, 51 for the Republic of Korea, 52 for Malaysia and 53 for Thailand. Subsequent numbers shall be assigned to other countries in the chronological order in which they ratify or accede to the Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, and the numbers thus assigned shall be communicated by the Secretary-General of the United Nations to the Contracting Parties to the Agreement.

5.5. In the absence of specific instructions lamps constituting a pair shall:

5.5.1. be fitted to the vehicle symmetrically in relation to the median longitudinal plane (this estimate to be based on the exterior geometrical form of the lamp and not on the edge of its illuminating surface referred to in paragraph 2.9);

5.5.2. be symmetrical to one another in relation to the median longitudinal plane, this requirement is not valid with regard to the interior structure of the lamp;

5.5.3. satisfy the same colorimetric requirements; and

5.5.4. have substantially identical photometric characteristics.

5.6. On vehicles whose external shape is asymmetrical the above requirements shall be satisfied so far as is possible.

5.7. Grouped, combined or reciprocally incorporated lamps

5.7.1. Lamps may be grouped, combined or reciprocally incorporated with one another provided that all requirements regarding colour, position, orientation, geometric visibility, electrical connections and other requirements, if any, are fulfilled.

5.7.1.1. However, where stop lamps and direction indicator lamps are grouped, any horizontal or vertical straight line passing through the projections of the apparent surfaces of these functions on a plane perpendicular to the reference axis, shall not intersect more than two borderlines separating adjacent areas of different colour.

5.7.2. Where the apparent surface of a single lamp is composed of two or more distinct parts, it shall satisfy the following requirements:

5.7.2.1. Either the total area of the projection of the distinct parts on a plane tangent to the exterior surface of the transparent material and perpendicular to the reference axis shall occupy not less than 60 % of the smallest quadrilateral circumscribing the said projection, or the distance between two adjacent/tangential distinct parts shall not exceed 15 mm when measured perpendicularly to the reference axis.

5.8. The maximum height above the ground shall be measured from the highest point and the minimum height from the lowest point of the apparent surface in the direction of the reference axis.

In the case of dipped-beam headlamp, the minimum height in relation to the ground is measured from the lowest point of the effective outlet of the optical system (e.g. reflector, lens, projection lens) independent of its utilisation.

Where the (maximum and minimum) height above the ground clearly meets the requirements of the Regulation, the exact edges of any surface need not be determined.

5.8.1. The position, as regards width, will be determined from that edge of the apparent surface in the direction of the reference axis which is the furthest from the median longitudinal plane of the vehicle when referred to the overall width, and from the inner edges of the apparent surface in the direction of the reference axis when referred to the distance between lamps.

Where the position, as regards width, clearly meets the requirements of the Regulation, the exact edges of any surface need not be determined.

5.9. In the absence of specific instructions, no lamps other than direction-indicator lamps, the vehicle-hazard warning signal and amber side-marker lamps complying with paragraph 6.18.7 below, shall be flashing lamps.

5.10. No red light which could give rise to confusion shall be emitted from a lamp as defined in paragraph 2.7 in a forward direction and no white light which could give rise to confusion, other than from the reversing lamp, shall be emitted from a lamp as defined in paragraph 2.7 in a rearward direction. No account shall be taken of lighting devices fitted for the interior lighting of the vehicle. In case of doubt, this requirement shall be verified as follows:

5.10.1. For the visibility of red light towards the front of a vehicle, with the exception of a red rearmost side-marker lamp, there must be no direct visibility of the apparent surface of a red lamp if viewed by an observer moving within Zone 1 as specified in Annex 4.

5.10.2. For the visibility of white light towards the rear, there must be no direct visibility of the apparent surface of a white lamp if viewed by an observer moving within Zone 2 in a transverse plane situated 25 m behind the vehicle (see Annex 4);

5.10.3. In their respective planes, the zones 1 and 2 explored by the eye of the observer are bounded:

5.10.3.1. in height, by two horizontal planes 1 m and 2,2 m respectively above the ground;

5.10.3.2. in width, by two vertical planes which, forming to the front and to the rear respectively an angle of 15° outwards from the vehicle's median longitudinal plane, pass through the point or points of contact of vertical planes parallel to the vehicle's median longitudinal plane delimiting the vehicle's overall width; if there are several points of contact, the foremost shall correspond to the forward plane and the rearmost to the rearward plane.

5.11. The electrical connections must be such that the front and rear position lamps, the end-outline marker lamps, if they exist, the side-marker lamps, if they exist, and the rear registration plate lamp can only be switched on and off simultaneously. This condition does not apply when using front and rear position lamps, as well as side-marker lamps when combined or reciprocally incorporated with said lamps, as parking lamps and when side-marker lamps are permitted to flash.

5.12. The electrical connections must be such that the main-beam and dipped-beam headlamps and the front fog lamps cannot be switched on unless the lamps referred to in paragraph 5.11 are also switched on. This requirement shall not apply, however, to main-beam or dipped-beam headlamps when their luminous warnings consist of the intermittent lighting up at short intervals of the main-beam headlamp or the intermittent lighting up at short intervals of the dipped-beam headlamp or the alternate lighting up at short intervals of the main-beam and dipped beam headlamps.

5.13. **Tell-tale**

Where a closed-circuit tell-tale is prescribed by this Regulation it may be replaced by an 'operating' tell-tale.

5.14. **Concealable lamps**

5.14.1. The concealment of lamps shall be prohibited, with the exception of the main-beam headlamps, the dipped-beam headlamps and the front fog lamps, which may be concealed when they are not in use.

5.14.2. In the event of any failure affecting the operation of the concealment device(s) the lamps shall remain in the position of use, if already in use, or shall be capable of being moved into the position of use without the aid of tools.

5.14.3. It must be possible to move the lamps into the position of use and to switch them on by means of a single control, without excluding 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.

5.14.4. It must not be possible deliberately, from the driver's seat, to stop the movement of switched-on lamps before they reach the position of use. If there is a danger of dazzling other road users by the movement of the lamps, they may light up only when they have reached their position of use.

5.14.5. When the concealment device has a temperature of – 30 °C to + 50 °C the headlamps must be capable of reaching the position of use within three seconds of initial operation of the control.

5.15. The colours of the light emitted by the lamps are the following:

main-beam headlamp:	white
dipped-beam headlamp:	white
front fog lamp:	white or selective yellow
reversing lamp:	white
direction-indicator lamp:	amber
hazard warning signal:	amber
stop lamp:	red
rear registration plate lamp:	white
front position lamp:	white
rear position lamp:	red
rear fog lamp:	red
parking lamp:	white in front, red at the rear, amber if reciprocally incorporated in the side direction-indicator lamps or in the side-marker lamps.
side-marker lamp:	amber; however the rearmost side-marker lamp can be red if it is grouped or combined or reciprocally incorporated with the rear position lamp, the rear end-outline marker lamp, the rear fog lamp, the stop lamp or is grouped or has part of the light emitting surface in common with the rear retro-reflector.
end-outline marker lamp:	white in front, red at the rear
daytime running lamp:	white
rear retro-reflector, non-triangular:	red
rear retro-reflector, triangular:	red
front retro-reflector, non-triangular:	identical to incident light [1]
side retro-reflector, non-triangular:	amber; however the rearmost side retro-reflector can be red if it is grouped or has part of the light emitting surface in common with the rear position lamp, the rear end-outline marker lamp, the rear fog lamp, the stop-lamp or the red rearmost side-marker lamp.
cornering lamp:	white
conspicuity marking:	white or yellow to the side; red or yellow to the rear [2].

[1] Also known as white or colourless retro-reflector.
[2] Nothing in this Regulation shall preclude the Contracting Parties applying this Regulation from allowing the use of white conspicuity markings to the rear in their territories.

5.16. **Number of lamps**

5.16.1. The number of lamps mounted on the vehicle should be equal to the number(s) specified in each of paragraphs 6.1 to 6.20.

5.17. Any lamp may be installed on movable components provided that the conditions specified in paragraphs 5.18, 5.19 and 5.20 are fulfilled.

5.18. Rear position lamps, rear direction-indicators and rear retro-reflectors, triangular as well as non triangular, may be installed on movable components only:

5.18.1. if at all fixed positions of the movable components the lamps on the movable components meet all the position, geometric visibility and photometric requirements for those lamps. Should the above functions be obtained by an assembly of two lamps marked 'D' (see paragraph 2.16.1) only one of these lamps needs to meet the above-mentioned requirements;

or

5.18.2. where additional lamps for the above functions are fitted and are activated, when the movable component is in any fixed open position, provided that these additional lamps satisfy all the position, geometric visibility and photometric requirements applicable to the lamps installed on the movable component.

5.19. When the movable components are in a position other than a 'normal position of use', the devices installed on them shall not cause undue discomfort to road users.

5.20. When a lamp is installed on a movable component and the movable component is in the 'normal position(s) of use', the lamp must always return to the position(s) specified by the manufacturer in accordance with this Regulation. In the case of dipped-beam headlamps and front fog lamps, this requirement shall be considered satisfied if, when the movable components are moved and returned to the normal position 10 times, no value of the angular inclination of these lamps, relative to its support, measured after each operation of the movable component, differs by more than 0,15 % from the average of the 10 measured values. If this value is exceeded each limit specified in paragraph 6.2.6.1.1 shall then be modified by this excess to decrease the allowed range of inclinations when checking the vehicle according to Annex 6.

5.21. The apparent surface in the direction of the reference axis of front and rear position lamps, front and rear direction-indicator lamps and retro-reflectors shall not be hidden more than 50 % by any movable component, with or without a light-signalling device installed on it, in any fixed position different from the 'normal position of use'.

If the above requirement is not practicable:

5.21.1. additional lamps satisfying all the position, geometric visibility and photometric requirements for the above indicated lamps shall be activated when the apparent surface in the direction of the reference axis of these lamps is more than 50 % hidden by the movable component;

or

5.21.2. a remark in the communication form (item 10.1 of Annex 1) shall inform other Administrations that more than 50 % of the apparent surface in the direction of the reference axis can be hidden by the movable components;

and

a notice in the vehicle shall inform the user that in certain position(s) of the movable components other road users shall be warned of the presence of the vehicle on the road; for example by means of a warning triangle or other devices according to national requirements for use on the road.

5.21.3. Paragraph 5.21.2 does not apply to retro-reflectors.

5.22. With the exception of retro-reflectors, a lamp even bearing an approval mark is deemed not to be present when it cannot be made to operate by the sole installation of a light source.

5.23. Lamps shall be fitted in a vehicle in such a way that the light source can be correctly replaced according to the instructions of the vehicle manufacturer without the use of special tools, other than those provided with the vehicle by the manufacturer. This requirement is not applicable to:

(a) devices approved with a non-replaceable light source;

(b) devices approved with light sources according to Regulation No 99.

5.24. Any temporary fail-safe replacement of the light-signalling function of a rear position lamp is allowed, provided that the substituting function in case of a failure is similar in colour, main intensity and position to the function that has ceased to operate and provided that the substituting device remains operational in its original safety function. During substitution, a tell-tale on the dashboard (see paragraph 2.18 of this Regulation) shall indicate occurrence of a temporary replacement and need for repair.

6. INDIVIDUAL SPECIFICATIONS

6.1. **Main-beam headlamp**

6.1.1. *Presence*

Mandatory on motor vehicles. Prohibited on trailers.

6.1.2. *Number*

Two or four.

For vehicles of the category N_3:

Two extra main-beam headlamps may be installed.

Where a vehicle is fitted with four concealable headlamps the installation of two additional headlamps shall only be authorised for the purpose of light-signalling, consisting of intermittent illumination, at short intervals (see paragraph 5.12) in daylight.

6.1.3. *Arrangement*

No individual specifications.

6.1.4. *Position*

6.1.4.1. In width: no individual specifications.

6.1.4.2. In height: no individual specifications.

6.1.4.3. In length: at the front of the vehicle and fitted in such a way that the light emitted does not cause discomfort to the driver either directly or indirectly through the rear-view mirrors and/or other reflecting surfaces of the vehicle.

6.1.5. *Geometric visibility*

The visibility of the illuminating surface, including its visibility in areas which do not appear to be illuminated in the direction of observation considered, must be ensured within a divergent space defined by generating lines based on the perimeter of the illuminating surface and forming an angle of not less than 5° with the axis of reference of the headlamp. The origin of the angles of geometric visibility is the perimeter of the projection of the illuminating surface on a transverse plane tangent to the foremost part of the lens of the headlamp.

6.1.6. *Orientation*

Towards the front.

Not more than one main-beam headlamp on each side of the vehicle may swivel to produce bend lighting.

6.1.7. *Electrical connections*

6.1.7.1. The main-beam headlamps may be switched on either simultaneously or in pairs. In case the extra two main-beam headlamps are installed, as permitted under paragraph 6.1.2 for vehicles of the category N_3 only, no more than two pairs may be simultaneously lit. For changing over from the dipped to the main beam at least one pair of main-beam headlamps shall be switched on. For changing over from the main-beam to the dipped-beam all main-beam headlamps shall be switched off simultaneously.

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

6.1.7.3. Where four concealable headlamps are fitted their raised position must prevent the simultaneous operation of any additional headlamps fitted, if these are intended to provide light signals consisting of intermittent illumination at short intervals (see paragraph 5.12) in daylight.

6.1.8. *Tell-tale*

Circuit-closed tell-tale mandatory.

6.1.9. *Other requirements*

6.1.9.1. The aggregate maximum intensity of the main-beam headlamps which can be switched on simultaneously shall not exceed 225 000 cd, which corresponds to a reference value of 75.

6.1.9.2. This maximum intensity shall be obtained by adding together the individual reference marks which are indicated on the several headlamps. The reference mark '10' shall be given to each of the headlamps marked 'R' or 'CR'.

6.2. **Dipped-beam headlamp**

6.2.1. *Presence*

Mandatory on motor vehicles. Prohibited on trailers.

6.2.2. *Number*

Two.

6.2.3. *Arrangement*

No special requirement.

6.2.4. *Position*

6.2.4.1. In width: that edge of the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall be not more than 400 mm from the extreme outer edge of the vehicle.

The inner edges of the apparent surfaces in the direction of the reference axes shall be not less than 600 mm apart. This does not apply, however, for M_1 and N_1 category vehicles; for all other categories of motor vehicles this distance may be reduced to 400 mm where the overall width of the vehicle is less than 1 300 mm.

6.2.4.2. In height: not less than 500 mm and not more than 1 200 mm above the ground. For category N_3G (off-road) vehicles [1] the maximum height may be increased to 1 500 mm.

6.2.4.3. In length: at the front of the vehicle. This requirement shall be deemed to be satisfied if the light emitted does not cause discomfort to the driver either directly, or indirectly through the rear-view mirrors and/or other reflecting surfaces of the vehicle.

6.2.5. *Geometric visibility*

Defined by angles α and ß as specified in paragraph 2.13:

α = 15° upwards and 10° downwards,

ß = 45° outwards and 10° inwards.

Since the photometric values required for dipped-beam headlamps do not cover the full geometric field of vision, a minimum value of 1 cd in the space remaining is required for type-approval purposes. The presence of partitions or other items of equipment near the headlamp shall not give rise to secondary effects causing discomfort to other road users.

6.2.6. *Orientation*

Towards the front.

6.2.6.1. Vertical orientation

6.2.6.1.1. The initial downward inclination of the cut-off of the dipped-beam to be set in the unladen vehicle state with one person in the driver's seat shall be specified within an accuracy of 0.1 % 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.

6.2.6.1.2. 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 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:

$h < 0{,}8$

limits: between − 0,5 % and − 2,5 %
initial aiming: between − 1,0 % and − 1,5 %

$0{,}8 < h < 1{,}0$

limits: between − 0,5 % and − 2,5 %
initial aiming: between − 1,0 % and − 1,5 %

[1] As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3), Annex 7 (document TRANS/WP.29/78/Rev.1/Amend.2, as last amended by Amend.4).

or, at the discretion of the manufacturer,

limits: between – 1,0 % and – 3,0 %
initial aiming: between – 1,5 % and – 2,0 %

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 > 1,0

limits: between – 1,0 % and – 3,0 %
initial aiming: between – 1,5 % and – 2,0 %

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

For category N_3G (off-road) vehicles where the headlamps exceed a height of 1 200 mm, the limits for the vertical inclination of the cut-off shall be between: – 1,5 % and – 3,5 %.

The initial aim shall be set between: – 2 % and – 2,5 %.

6.2.6.2. Headlamp levelling device

6.2.6.2.1. In the case where a headlamp levelling device is necessary to satisfy the requirements of paragraphs 6.2.6.1.1 and 6.2.6.1.2, the device shall be automatic.

6.2.6.2.2. 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 6.2.6.1.1 by means of the usual adjusting screws or similar means.

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

Continually adjustable devices must 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 must be such as to ensure compliance with the range of values prescribed in paragraph 6.2.6.1.2 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).

6.2.6.2.3. In the event of a failure of devices described in paragraphs 6.2.6.2.1 and 6.2.6.2.2, 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.

6.2.6.3. Measuring procedure

6.2.6.3.1. After adjustment of the initial inclination, the vertical inclination of the dipped-beam, expressed in percent, shall be measured in static conditions under all the loading conditions defined in Annex 5.

6.2.6.3.2. The measurement of the variation of dipped-beam inclination as a function of load must be carried out in accordance with the test procedure set out in Annex 6.

6.2.6.4. Horizontal orientation

The horizontal orientation of one or both dipped-beam headlamps may be varied to produce bend lighting, provided that if the whole beam or the kink of the elbow of the cut-off is moved, the kink of the elbow of the cut-off shall not intersect the line of the trajectory of the centre of gravity of the vehicle at distances from the front of the vehicle which are larger than 100 times the mounting height of the respective dipped-beam headlamps.

6.2.7. *Electrical connections*

The control for changing over to the dipped-beam must switch off all main-beam headlamps simultaneously.

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

In the case of dipped-beam headlamps according to Regulation No 98, the gas-discharge light sources shall remain switched on during the main-beam operation.

One additional light source, located inside the dipped-beam headlamps or in a lamp (except the main-beam headlamp) grouped or reciprocally incorporated with the respective dipped-beam headlamps, may be activated to produce bend lighting, provided that the horizontal radius of curvature of the trajectory of the centre of gravity of the vehicle is 500 m or less. This may be demonstrated by the manufacturer by calculation or by other means accepted by the authority responsible for type approval.

Dipped-beam headlamps may be switched ON or OFF automatically. However, it shall be always possible to switch these dipped-beam headlamps ON and OFF manually.

6.2.8. *Tell-tale*

Tell-tale optional.

However, in the case where the whole beam or the kink of the elbow of the cut-off is moved to produce bend lighting, an operational tell-tale is mandatory; it shall be a flashing warning light which comes on in the event of a malfunction of the displacement of the kink of the elbow of the cut-off.

6.2.9. *Other requirements*

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

Dipped-beam headlamps with a light source having an objective luminous flux which exceeds 2 000 lumen shall only be installed in conjunction with the installation of headlamp cleaning device(s) according to Regulation No 45. [1] In addition, with respect to vertical inclination, the provisions of paragraph 6.2.6.2.2 shall not be applied.

Only dipped-beam headlamps according to Regulations No 98 or No 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).

6.3. **Front fog lamp**

6.3.1. *Presence*

Optional on motor vehicles. Prohibited on trailers.

[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.

6.3.2. *Number*

Two.

6.3.3. *Arrangement*

No special requirement.

6.3.4. *Position*

6.3.4.1. In width: that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

6.3.4.2. In height:

minimum: Not less than 250 mm above the ground.

maximum: For M_1 and N_1 category vehicles not more than 800 mm above the ground. For all other categories of vehicles no maximum height.

However, no point on the apparent surface in the direction of the reference axis must be higher than the highest point on the apparent surface in the direction of the reference axis of the dipped-beam headlamp.

6.3.4.3. In length: at the front of the vehicle. This requirement shall be deemed to be satisfied if the light emitted does not cause discomfort to the driver either directly, or indirectly through the rear-view mirrors and/or other reflecting surfaces of the vehicle.

6.3.5. *Geometric visibility*

Defined by angles α and ß as specified in paragraph 2.13:

α = 5° upwards and downwards,

ß = 45° outwards and 10° inwards.

6.3.6. *Orientation*

Towards the front.

The alignment of the front fog lamps must not vary according to the angle of lock of the steering.

They must be directed forward without causing undue dazzle or discomfort to oncoming drivers and other road users.

6.3.7. *Electrical connections*

It must be possible to switch the front fog lamps on and off independently of the main-beam headlamps, the dipped-beam headlamps or any combination of main- and dipped-beam headlamps.

6.3.8. *Tell-tale*

Circuit-closed tell-tale mandatory. An independent non-flashing warning light.

6.3.9. *Other requirements*

None.

6.4. **Reversing lamp**

6.4.1. *Presence*

Mandatory on motor vehicles and on trailers of categories O_2, O_3 and O_4. Optional on trailers of category O_1.

6.4.2. *Number*

6.4.2.1. One device mandatory and a second device optional on motor vehicles of category M_1 and on all other vehicles with a length not exceeding 6 000 mm.

6.4.2.2. Two devices mandatory and two devices optional on all vehicles with a length exceeding 6 000 mm, except vehicles of category M_1.

6.4.3. *Arrangement*

No special requirement.

6.4.4. *Position*

6.4.4.1. In width: no special requirement.

6.4.4.2. In height: not less than 250 mm and not more than 1 200 mm above the ground.

6.4.4.3. In length: at the rear of the vehicle.

However, if installed, the two optional devices mentioned in paragraph 6.4.2.2 shall be fitted on the side or rear of the vehicle, in conformity with the requirements of paragraphs 6.4.5 and 6.4.6.

6.4.5. *Geometric visibility*

Defined by angles α and β, as specified in paragraph 2.13.:

α = 15° upwards and 5° downwards,

β = 45° to right and to left if there is only one device,

45° outwards and 30° inwards if there are two.

The reference axis of the two optional devices mentioned in paragraph 6.4.2.2, if fitted on the side of the vehicle shall be orientated sideward horizontally with an inclination of 10° ± 5° in relation to the median longitudinal plane of the vehicle.

6.4.6. *Orientation*

Rearwards

In the case of the two optional devices mentioned in paragraph 6.4.2.2, if fitted on the side of the vehicle, the above-mentioned requirements of paragraph 6.4.5 shall not be applied. However, the reference axis of these devices shall be orientated outwards not more than 15° horizontally towards the rear in relation to the median longitudinal plane of the vehicle.

6.4.7. *Electrical connections*

6.4.7.1. They shall be such that the lamp can light up only if the reverse gear is engaged and if the device which controls the starting and stopping of the engine is in such a position that operation of the engine is possible. It shall not light up or remain lit if either of the above conditions is not satisfied.

6.4.7.2. Moreover, the electrical connections of the two optional devices mentioned in paragraph 6.4.2.2 shall be such that these devices cannot illuminate unless the lamps referred to in paragraph 5.11 are switched on.

It is allowed to switch on the devices fitted on the side of the vehicle, for slow manoeuvres in forward motion. For such purposes, the devices shall be activated and deactivated manually by a separate switch and may remain illuminated even when reverse gear is disengaged. However, if the forward speed of the vehicle exceeds 10 km/h the devices shall be switched off automatically and shall remain switched off until deliberately switched on again.

6.4.8. *Tell-tale*

Tell-tale optional.

6.4.9. *Other requirements*

None.

6.5. **Direction-indicator lamp**

6.5.1. *Presence (see figure below)*

Mandatory. Types of direction-indicator lamps fall into categories (1, 1a, 1b, 2a, 2b, 5 and 6) the assembly of which on one vehicle constitutes an arrangement ('A' and 'B').

Arrangement 'A' shall apply to all motor vehicles.

Arrangement 'B' shall apply to trailers only.

6.5.2. *Number*

According to the arrangement.

6.5.3. *Arrangements (see figure below)*

A: Two front direction-indicator lamps of the following categories:

1 or 1a or 1b, if the distance between the edge of the apparent surface in the direction of the reference axis of this lamp and that of the apparent surface in the direction of the reference axis of the dipped-beam headlamp and/or the front fog lamp, if there is one, is at least 40 mm;

1a or 1b, if the distance between the edge of the apparent surface in the direction of the reference axis of this lamp and that of the apparent surface in the direction of the reference axis of the dipped-beam headlamp and/or the front fog lamp, if there is one, is greater than 20 mm and less than 40 mm;

1b, if the distance between the edge of the apparent surface in the direction of the reference axis of this lamp and that of the apparent surface in the direction of the reference axis of the dipped-beam headlamp and/or the front fog lamp, if there is one, is less than or equal to 20 mm;

two rear direction-indicator lamps (category 2a or 2b);

two optional lamps (category 2a or 2b) on all vehicles in categories M_2, M_3, N_2, N_3.

two side direction-indicator lamps of the categories 5 or 6 (minimum requirements):

5

for all M_1 vehicles;

for N_1, M_2 and M_3 vehicles not exceeding 6 metres in length.

6

for all N_2 and N_3 vehicles;

for N_1, M_2 and M_3 vehicles exceeding 6 metres in length.

It is permitted to replace category 5 side direction-indicator lamps by category 6 side direction-indicator lamps in all instances.

Where lamps combining the functions of front direction-indicator lamps (categories 1, 1a, 1b) and side direction-indicator lamps (categories 5 or 6) are fitted, two additional side direction-indicator lamps (categories 5 or 6) may be fitted to meet the visibility requirements of paragraph 6.5.5.

B: Two rear direction-indicator lamps (categories 2a or 2b).

two optional lamps (category 2a or 2b) on all vehicles in categories O_2, O_3 and O_4.

6.5.4. *Position*

6.5.4.1. In width: the edge of the apparent surface in the direction of the reference axis farthest from the median longitudinal plane of the vehicle must not be more than 400 mm from the extreme outer edge of the vehicle. This condition shall not apply to the optional rear lamps.

The distance between the inner edges of the two apparent surfaces in the direction of the reference axes shall not be less than 600 mm.

This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1 300 mm.

6.5.4.2. In height: above the ground.

6.5.4.2.1. The height of the light-emitting surface of the side direction-indicator lamps of categories 5 or 6 must not be:

less than: 350 mm for M_1 and N_1 category of vehicles, and 500 mm for all other categories of vehicles, both measured from the lowest point; and

more than: 1 500 mm, measured from the highest point.

6.5.4.2.2. The height of the direction-indicator lamps of categories 1, 1a, 1b, 2a and 2b, measured in accordance with paragraph 5.8, shall not be less than 350 mm or more than 1 500 mm.

6.5.4.2.3. If the structure of the vehicle does not permit these upper limits, measured as specified above, to be respected, and if the optional lamps are not installed, they may be increased to 2 300 mm for side direction-indicator lamps of categories 5 and 6, and to 2 100 mm for the direction-indicator lamps of categories 1, 1a, 1b, 2a and 2b.

6.5.4.2.4. If optional lamps are installed, they shall be placed at a height compatible with the applicable requirements of paragraph 6.5.4.1, the symmetry of the lamps, and at a vertical distance as large as the shape of the bodywork makes it possible, but not less than 600 mm above the mandatory lamps.

6.5.4.3. In length (see figure below)

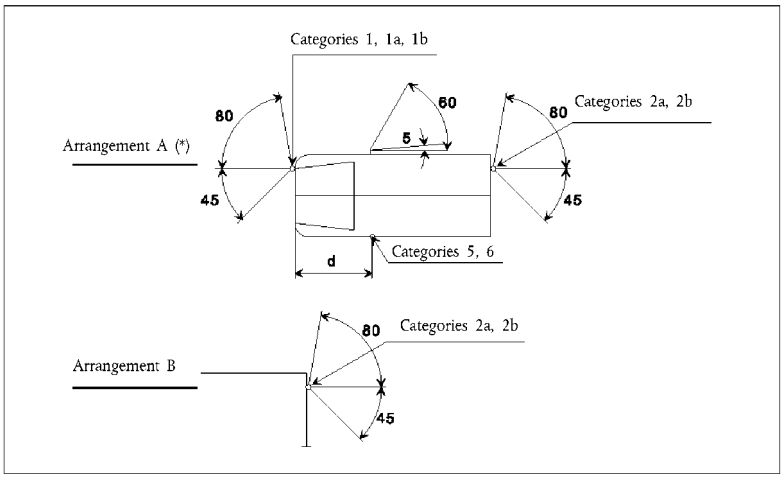
The distance between the light-emitting surface of the side direction-indicator lamp (categories 5 and 6) and the transverse plane which marks the forward boundary of the vehicle's overall length, shall not exceed 1 800 mm. However, for M_1 and N_1 category vehicles, and for all other categories of vehicles if the structure of the vehicle makes it impossible to comply with the minimum angles of visibility, this distance may be increased to 2 500 mm.

6.5.5. *Geometric visibility*

6.5.5.1. Horizontal angles: (see figure below)

Vertical angles: 15° above and below the horizontal for direction-indicator lamps of categories 1, 1a, 1b, 2a, 2b and 5. The vertical angle below the horizontal may be reduced to 5° if the lamps are less than 750 mm above the ground; 30° above and 5° below the horizontal for direction-indicator lamps of category 6. The vertical angle above the horizontal may be reduced to 5° if the optional lamps are not less than 2 100 mm above the ground.

Figure (see paragraph 6.5.)

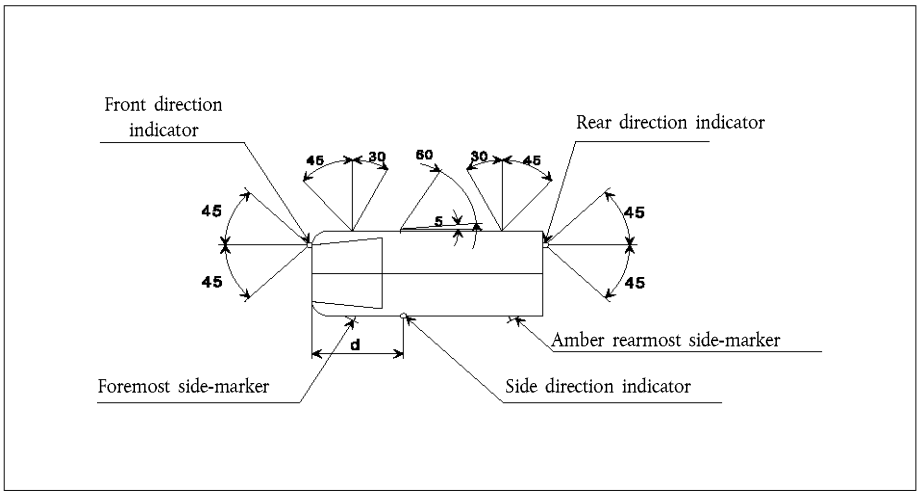


(*) The value of 5° given for dead angle of visibility to the rear of the side direction-indicator is an upper limit. d ≤ 1,80 m (for M_1 and N_1 category vehicles d ≤ 2,50 m).

6.5.5.2. or, at the discretion of the manufacturer, for M_1 and N_1 category vehicles [1]:

Front and rear direction-indicator lamps, as well as side-marker lamps:

Horizontal angles see figure below:



Vertical angles: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° if the lamps are less than 750 mm above the ground.

[1] The value of 5° given for the dead angle of visibility to the rear of the side direction-indicator is an upper limit. d ≤ 2,50 m.

To be considered visible, the lamp must provide an unobstructed view of the apparent surface of at least 12,5 square centimetres, except for side direction-indicators of categories 5 and 6. The illuminating surface area of any retro-reflector that does not transmit light shall be excluded.

6.5.6. *Orientation*

According to the specifications for installation by the manufacturer, if any.

6.5.7. *Electrical connections*

Direction-indicator lamps shall switch on independently of the other lamps. All direction-indicator lamps on one side of a vehicle shall be switched on and off by means of one control and shall flash in phase.

On M_1 and N_1 vehicles less than 6 m in length, with an arrangement complying with paragraph 6.5.5.2. above, the amber side-marker lamps, when mounted, shall also flash at the same frequency (in phase) with the direction indicator lamps.

6.5.8. *Tell-tale*

Operating tell-tale mandatory for front and rear direction-indicator lamps. It may be visual or auditory or both. If it is visual it shall be a flashing light which, at least in the event of the malfunction of any of the front or rear direction-indicator lamps, is either extinguished, or remains alight without flashing, or shows a marked change of frequency. If it is entirely auditory it shall be clearly audible and shall show a marked change of frequency, at least in the event of the malfunction of any of the front or rear direction-indicator lamps.

If a motor vehicle is equipped to draw a trailer, it must be fitted with a special visual operational tell-tale for the direction-indicator lamps on the trailer unless the tell-tale of the drawing vehicle allows the failure of any one of the direction-indicator lamps on the vehicle combination thus formed to be detected.

For the optional pair of direction-indicator lamps on trailers, operating tell-tale shall not be mandatory.

6.5.9. *Other requirements*

The light shall be a flashing light flashing 90 ± 30 times per minute.

Operation of the light-signal control shall be followed within not more than one second by the emission of light and within not more than one and one-half seconds by its first extinction. If a motor vehicle is equipped to draw a trailer, the control of the direction-indicator lamps on the drawing vehicle shall also operate the indicator lamps of the trailer. In the event of failure, other than short-circuit, of one direction indicator lamp, the others must continue to flash, but the frequency in this condition may be different from that prescribed.

6.6. **Hazard warning signal**

6.6.1. *Presence*

Mandatory.

The signal shall be given by simultaneous operation of the direction-indicator lamps in accordance with the requirements of paragraph 6.5.

6.6.2. *Number*

As specified in paragraph 6.5.2.

6.6.3. *Arrangement*

As specified in paragraph 6.5.3.

6.6.4. *Position*

6.6.4.1. W i d t h

As specified in paragraph 6.5.4.1.

6.6.4.2. H e i g h t

As specified in paragraph 6.5.4.2.

6.6.4.3. L e n g t h

As specified in paragraph 6.5.4.3.

6.6.5. *Geometric visibility*

As specified in paragraph 6.5.5.

6.6.6. *Orientation*

As specified in paragraph 6.5.6.

6.6.7. *Electrical connections*

The signal shall be operated by means of a separate control enabling all the direction-indicator lamps to flash in phase.

On M_1 and N_1 vehicles less than 6 m in length, with an arrangement complying with paragraph 6.5.5.2, the amber side-marker lamps, when mounted, shall also flash at the same frequency (in phase) with the direction indicator lamps.

6.6.8. *Tell-tale*

Circuit-closed tell-tale mandatory. Flashing warning light, which can operate in conjunction with the tell-tale(s) specified in paragraph 6.5.8.

6.6.9. *Other requirements*

As specified in paragraph 6.5.9. If a power-driven vehicle is equipped to draw a trailer the hazard warning signal control shall also be capable of bringing the direction-indicator lamps on the trailer into action. The hazard warning signal shall be able to function even if the device which starts or stops the engine is in a position which makes it impossible to start the engine.

6.7. **Stop lamp**

6.7.1. *Presence*

Devices of S1 or S2 categories:	mandatory on all categories of vehicles.
Devices of S3 category:	mandatory on M_1 and N_1 categories of vehicles, except for chassis-cabs and those N_1 category vehicles with open cargo space; optional on other categories of vehicles.

6.7.2. *Number*

Two S1 or S2 category devices and one S3 category device on all categories of vehicles.

6.7.2.1. Except the case where category S3 device is installed, two optional category S1 or S2 devices may be installed on vehicles in categories M_2, M_3, N_2, N_3, O_2, O_3, and O_4.

6.7.2.2. Only, when the median longitudinal plane of the vehicle is not located on a fixed body panel but separates one or two movable parts of the vehicle (e.g. doors), and lacks sufficient space to install a single device of the S3 category on the median longitudinal plane above such movable parts, either:

(a) two devices of the S3 category type 'D' may be installed, or

(b) one device of the S3 category may be installed offset to the left or to the right of the median longitudinal plane.

6.7.3. *Arrangement*

No special requirement.

6.7.4. *Position*

6.7.4.1. In width:

For M_1 and N_1 category vehicles: For S1 or S2 categories devices that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

For the distance in between the inner edges of the apparent surfaces in the direction of the reference axes there is no special requirement.

For all other categories of vehicles: For S1 or S2 categories devices the distance in between the inner edges of the apparent surfaces in the direction of the reference axes shall be not less than 600 mm. This distance may be reduced to 400 mm if the overall width of the vehicle is less than 1 300 mm.

For S3 category devices: the centre of reference shall be situated on the median longitudinal plane of the vehicle. However, in the case where the two devices of the S3 category are installed, according to paragraph 6.7.2, they shall be positioned as close as possible to the median longitudinal plane, one on each side of this plane.

In the case where one S3 category lamp offset from the median longitudinal plane is permitted according to paragraph 6.7.2, this offset shall not exceed 150 mm from the median longitudinal plane to the centre of reference of the lamp.

6.7.4.2. In height:

6.7.4.2.1. For S1 or S2 categories devices: above the ground, not less than 350 mm nor more than 1 500 mm (2 100 mm if the shape of the bodywork makes it impossible to keep within 1 500 mm and if the optional lamps are not installed).

If the optional lamps are installed, they shall be positioned at a height compatible with the requirements of the width and the symmetry of the lamps, and at a vertical distance as large as the shape of the bodywork makes it possible, but not less than 600 mm above the mandatory lamps.

6.7.4.2.2. For S3 category devices, the horizontal plane tangential to the lower edge of the apparent surface shall:

(a) either not be more than 150 mm below the horizontal plane tangential to the lower edge of the exposed surface of the glass or glazing of the rear window, or

(b) not be less than 850 mm above the ground.

However, the horizontal plane tangential to the lower edge of the apparent surface of S3 category device shall be above the horizontal plane tangential to the upper edge of the apparent surface of S1 or S2 categories devices.

6.7.4.3. In length:

For S1 or S2 categories devices: at the rear of the vehicle.

For S3 category devices: no special requirement.

6.7.5. *Geometric visibility*

Horizontal angle: For S1 or S2 categories devices:

45° to the left and to the right of the longitudinal axis of the vehicle;

For S3 category devices: 10° to the left and to the right of the longitudinal axis of the vehicle;

Vertical angle: For S1 or S2 categories devices: 15° above and below the horizontal. However, the vertical angle below the horizontal may be reduced to 5°, if the height of the lamp is less than 750 mm. The vertical angle above the horizontal may be reduced to 5° in the case of optional lamps not less than 2 100 mm above the ground;

For S3 category devices: 10° above and 5° below the horizontal.

6.7.6. *Orientation*

Towards the rear of the vehicle.

6.7.7. *Electrical connections*

6.7.7.1. All stop lamps must light up simultaneously when the braking system provides the relevant signal defined in Regulations Nos. 13 and 13-H.

6.7.7.2. The stop lamps need not function if the device, which starts and/or stops the engine, is in a position that makes it impossible for the engine to operate.

6.7.8. *Tell-tale*

Tell-tale optional; where fitted, this tell-tale must be an operating tell-tale consisting of a non-flashing warning light which comes on in the event of the malfunctioning of the stop lamps.

6.7.9. *Other requirements*

6.7.9.1. The S3 category device may not be reciprocally incorporated with any other lamp.

6.7.9.2. The S3 category device may be installed outside or inside the vehicle.

6.7.9.2.1. In the case where it is installed inside the vehicle:

the light emitted shall not cause discomfort to the driver through the rear-view mirrors and/or other surfaces of the vehicle (i.e. rear window).

6.8. **Rear registration plate lamp**

6.8.1. *Presence*

Mandatory.

6.8.2. *Number*

Such that the device illuminates the site of the registration plate.

6.8.3. *Arrangement*

Such that the device illuminates the site of the registration plate.

6.8.4. *Position*

6.8.4.1. In width: such that the device illuminates the site of the registration plate.

6.8.4.2. In height: such that the device illuminates the site of the registration plate.

6.8.4.3. In length: such that the device illuminates the site of the registration plate.

6.8.5. *Geometric visibility*

Such that the device illuminates the site of the registration plate.

6.8.6. *Orientation*

Such that the device illuminates the site of the registration plate.

6.8.7. *Electrical connections*

In accordance with paragraph 5.11.

6.8.8. *Tell-tale*

Tell-tale optional. If it exists, its function must be carried out by the tell-tale required for the front and rear position lamps.

6.8.9. *Other requirements*

When the rear registration plate lamp is combined with the rear position lamp, reciprocally incorporated in the stop lamp or in the rear fog lamp, the photometric characteristics of the rear registration plate lamp may be modified during the illumination of the stop lamp or the rear fog lamp.

6.9. **Front position lamp**

6.9.1. *Presence*

Mandatory on all motor vehicles.

Mandatory on trailers over 1 600 mm wide.

Optional on trailers which are not more than 1 600 mm wide.

6.9.2. *Number*

Two.

6.9.3. *Arrangement*

No special requirement.

6.9.4. *Position*

6.9.4.1. In width: that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

In the case of a trailer, that point on the apparent surface in the direction of the reference axis which is farthest from the median longitudinal plane shall not be more than 150 mm from the extreme outer edge of the vehicle.

The distance between the inner edges of the two apparent surfaces in the direction of the reference axes shall:

For M_1 and N_1 category vehicles: have no special requirement;

For all other categories of vehicles: be not less than 600 mm. This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1 300 mm.

6.9.4.2. In height: above the ground, not less than 350 mm nor more than 1 500 mm (2 100 mm for O_1 and O_2 categories of vehicles, or if for any other categories of vehicles the shape of the bodywork makes it impossible to keep within 1 500 mm).

6.9.4.3. In length: no individual specification.

6.9.4.4. Where the front position lamp and another lamp are reciprocally incorporated, the apparent surface in the direction of the reference axis of the other lamp must be used to verify compliance with the positioning requirements (paragraphs 6.9.4.1 to 6.9.4.3).

6.9.5. *Geometric visibility*

6.9.5.1. Horizontal angle for the two position lamps:

45° inwards and 80° outwards.

Inthe case of trailers, the angle inwards may be reduced to 5°.

Vertical angle:

15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of lamps less than 750 mm above the ground.

6.9.5.2. For M_1 and N_1 category vehicles, as an alternative to paragraph 6.9.5.1, at the discretion of the manufacturer or his duly accredited representative, and only if a front side-marker lamp is installed on the vehicle.

Horizontal angle: 45° outwards to 45° inwards.

Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° if the lamps are less than 750 mm above the ground.

To be considered visible, the lamp must provide an unobstructed view of the apparent surface of at least 12,5 square centimetres. The illuminating surface area of any retro-reflector that does not transmit light shall be excluded.

6.9.6. *Orientation*

Forwards.

6.9.7. *Electrical connections*

In accordance with paragraph 5.11.

6.9.8. *Tell-tale*

Circuit-closed tell-tale mandatory. This tell-tale shall be non-flashing and shall not be required if the instrument panel lighting can only be turned on simultaneously with the front position lamps.

6.9.9. *Other requirements*

If one or more infrared radiation generator(s) is (are) installed inside the front position lamp, it (they) is (are) allowed to be activated only when the headlamp on the same side of the vehicle is switched on and the vehicle is in forward motion. In the event that the front position lamp or the headlamp on the same side fails, the infrared radiation generator(s) shall be automatically switched off.

6.10. **Rear position lamp**

6.10.1. *Presence*

Mandatory.

6.10.2. *Number*

Two.

6.10.2.1. Except the case where end-outline marker lamps are installed, two optional position lamps may be installed on all vehicles in categories M_2, M_3, N_2, N_3, O_2, O_3, and O_4.

6.10.3. *Arrangement*

No special requirement.

6.10.4. *Position*

6.10.4.1. In width: that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle. This condition shall not apply to the optional rear lamps.

The distance between the inner edges of the two apparent surfaces in the direction of the reference axes shall:

For M_1 and N_1 category vehicles: have no special requirement;

For all other categories of vehicles: be not less than 600 mm. This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1 300 mm.

6.10.4.2. In height: above the ground, not less than 350 mm nor more than 1 500 mm (2 100 mm if the shape of the bodywork makes it impossible to keep within 1 500 mm and if the optional lamps are not installed). If the optional lamps are installed, they shall be placed at a height compatible with the applicable requirements of paragraph 6.10.4.1, the symmetry of the lamps, and at a vertical distance as large as the shape of the bodywork makes it possible, but not less than 600 mm above the mandatory lamps.

6.10.4.3. In length: at the rear of the vehicle.

6.10.5. *Geometric visibility*

6.10.5.1. Horizontal angle: 45° inwards and 80° outwards.

Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of lamps less than 750 mm above the ground. The vertical angle above the horizontal may be reduced to 5° in the case of optional lamps not less than 2 100 mm above the ground.

6.10.5.2. For M_1 and N_1 category vehicles, as an alternative to paragraph 6.10.5.1, at the discretion of the manufacturer or his duly accredited representative, and only if a rear side-marker lamp is installed on the vehicle.

Horizontal angle: 45° outwards to 45° inwards.

Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° if the lamps are less than 750 mm above the ground.

To be considered visible, the lamp must provide an unobstructed view of the apparent surface of at least 12,5 square centimetres. The illuminating surface area of any retro-reflector that does not transmit light shall be excluded.

6.10.6. *Orientation*

Rearwards.

6.10.7. *Electrical connections*

In accordance with paragraph 5.11.

6.10.8. *Tell-tale*

Circuit-closed tell-tale mandatory. It must be combined with that of the front position lamps.

6.10.9. *Other requirements*

None.

6.11. **Rear fog lamp**

6.11.1. *Presence*

Mandatory.

6.11.2. *Number*

One or two.

6.11.3. *Arrangement*

No special requirement.

6.11.4. *Position*

6.11.4.1. In width: if there is only one rear fog-lamp, it must be on the opposite side of the median longitudinal plane of the vehicle to the direction of traffic prescribed in the country of registration, the centre of reference may also be situated on the median longitudinal plane of the vehicle.

6.11.4.2. In height: not less than 250 mm nor more than 1 000 mm above the ground. For category N_3G (off-road) vehicles, the maximum height may be increased to 1 200 mm.

6.11.4.3. In length: at the rear of the vehicle.

6.11.5. *Geometric visibility*

Defined by angles α and ß as specified in paragraph 2.13:

α = 5° upwards and 5° downwards;

ß = 25° to right and to left.

6.11.6. *Orientation*

Rearwards.

6.11.7. *Electrical connections*

These must be such that:

6.11.7.1. The rear fog-lamp(s) cannot be switched on unless the main beams, dipped beams or front fog-lamps are lit.

6.11.7.2. The rear fog-lamp(s) can be switched off independently of any other lamp.

6.11.7.3. Either of the following applies:

6.11.7.3.1. the rear fog lamp(s) may continue to operate until the position lamps are switched off, and the rear fog lamp(s) shall then remain off until deliberately switched on again;

6.11.7.3.2. a warning, at least audible, additional to the mandatory tell-tale (paragraph 6.11.8) shall be given if the ignition is switched off or the ignition key is withdrawn and the driver's door is opened, whether the lamps in (paragraph 6.11.7.1) are on or off, whilst the rear fog lamp switch is in the 'on' position.

6.11.7.4. Except as provided in paragraphs 6.11.7.1 and 6.11.7.3, the operation of the rear fog-lamp(s) shall not be affected by switching on or off any other lamps.

6.11.8. *Tell-tale*

Circuit-closed tell-tale mandatory. An independent non-flashing warning light.

6.11.9. *Other requirements*

In all cases, the distance between the rear fog-lamp and each stop-lamp must be greater than 100 mm.

6.12. **Parking lamp**

6.12.1. *Presence*

On motor vehicles not exceeding 6 m in length and not exceeding 2 m in width, optional.

On all other vehicles, prohibited.

6.12.2. *Number*

According to the arrangement.

6.12.3. *Arrangement*

Either two lamps at the front and two lamps at the rear, or one lamp on each side.

6.12.4. *Position*

6.12.4.1. In width: that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

Furthermore, if there are two lamps, they shall be on the sides of the vehicle.

6.12.4.2. In height:

For M_1 and N_1 category vehicles: no special requirement;

For all other categories of vehicles: above the ground, not less than 350 mm nor more than 1 500 mm (2 100 mm if the shape of the bodywork makes it impossible to keep within 1 500 mm).

6.12.4.3. In length: no special requirement.

6.12.5. *Geometric visibility*

Horizontal angle: 45° outwards, forwards and rearwards.

Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5°, however, if the height of the lamp is less than 750 mm.

6.12.6. *Orientation*

Such that the lamps meet the requirements for visibility forwards and rearwards.

6.12.7. *Electrical connections*

The connection must allow the parking lamp(s) on the same side of the vehicle to be lit independently of any other lamps.

The parking lamp(s) and, if applicable, the front and rear position lamps according to paragraph 6.12.9, must be able to operate even if the device which starts the engine is in a position which makes it impossible for the engine to operate. A device which automatically deactivates these lamps as a function of time is prohibited.

6.12.8. *Tell-tale*

Circuit-closed tell-tale optional. If there is one, it must not be possible to confuse it with the tell-tale for the front and rear position lamps.

6.12.9. *Other requirements*

The functioning of this lamp may also be performed by simultaneously switching on the front and rear position lamps on the same side of the vehicle.

6.13. **End-outline marker lamp**

6.13.1. *Presence*

Mandatory on vehicles exceeding 2,10 m in width. Optional on vehicles between 1,80 and 2,10 m in width. On chassis-cabs the rear end-outline marker lamps are optional.

6.13.2. *Number*

Two visible from the front and two visible from the rear.

6.13.3. *Arrangement*

No special requirement.

6.13.4. *Position*

6.13.4.1. In width:

Front and rear: as close as possible to the extreme outer edge of the vehicle. This condition is deemed to have been met when the point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane is not more than 400 mm from the extreme outer edge of the vehicle.

6.13.4.2. In height:

Front: Motor vehicles — the horizontal plane tangential to the upper edge of the apparent surface in the direction of the reference axis of the device must not be lower than the horizontal plane tangential to the upper edge of the transparent zone of the wind-screen.

Trailers and semi-trailers — at the maximum height compatible with the requirements relating to the width, design and operational requirements of the vehicle and to the symmetry of the lamps.

Rear: At the maximum height compatible with the requirements relating to the width, design and operational requirements of the vehicle and to the symmetry of the lamps.

6.13.4.3. In length, no special requirement.

6.13.5. *Geometric visibility*

Horizontal angle: 80° outwards.

Vertical angle: 5° above and 20° below the horizontal.

6.13.6. *Orientation*

Such that the lamps meet the requirements for visibility forwards and rearwards.

6.13.7. *Electrical connections*

In accordance with paragraph 5.11.

6.13.8. *Tell-tale*

Tell-tale optional. If it exists, its function shall be carried out by the tell-tale required for the front and rear position lamps.

6.13.9. *Other requirements*

Provided that all other requirements are met, the lamp visible from the front and the lamp visible from the rear on the same side of the vehicle may be combined in one device.

The position of an end-outline marker lamp in relation to corresponding position lamp shall be such that the distance between the projections on a transverse vertical plane of the points nearest to one another on the apparent surfaces in the direction of the respective reference axes of the two lamps considered is not less than 200 mm.

6.14. **Rear retro-reflector, non-triangular**

6.14.1. *Presence*

Mandatory on motor vehicles.

Provided that they are grouped together with the other rear light-signalling devices, optional on trailers.

6.14.2. *Number*

Two, the performances of which shall conform to the requirements concerning Class IA or IB retro-reflectors in Regulation No 3. Additional retro-reflecting devices and materials (including two retro-reflectors not complying with paragraph 6.14.4. below), are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.

6.14.3. *Arrangement*

No special requirement.

6.14.4. *Position*

6.14.4.1. In width: that point on the illuminating surface which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

The distance between the inner edges of the two apparent surfaces in the direction of the reference axes shall:

For M_1 and N_1 category vehicles: have no special requirement;

For all other categories of vehicles: be not less than 600 mm.

This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1 300 mm.

6.14.4.2. In height: above the ground, not less than 250 mm nor more than 900 mm (1 500 mm if the shape of the bodywork makes it impossible to keep within 900 mm).

6.14.4.3. In length: at the rear of the vehicle.

6.14.5. *Geometric visibility*

Horizontal angle: 30° inwards and outwards.

Vertical angle: 10° above and below horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of a retro-reflector less than 750 mm above the ground.

6.14.6. *Orientation*

Rearwards.

6.14.7. *Other requirements*

The illuminating surface of the retro-reflector may have parts in common with the apparent surface of any other lamp situated at the rear.

6.15. **Rear retro-reflector, triangular**

6.15.1. *Presence*

Mandatory on trailers.

Prohibited on motor vehicles.

6.15.2. *Number*

Two, the performances of which shall conform to the requirements concerning Class IIIA or Class IIIB retro-reflectors in Regulation No 3. Additional retro-reflecting devices and materials (including two retro-reflectors not complying with paragraph 6.15.4), are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.

6.15.3. *Arrangement*

The apex of the triangle shall be directed upwards.

6.15.4. *Position*

6.15.4.1. In width: that point on the illuminating surface which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

The inner edges of the retro-reflectors shall not be less than 600 mm apart. This distance may be reduced to 400 mm if the overall width of the vehicle is less than 1 300 mm.

6.15.4.2. In height: above the ground, not less than 250 mm nor more than 900 mm (1 500 mm if the shape of the bodywork makes it impossible to keep within 900 mm).

6.15.4.3. In length: at the rear of the vehicle.

6.15.5. *Geometric visibility*

Horizontal angle: 30° inwards and outwards.

Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of a retro-reflector less than 750 mm above the ground.

6.15.6. *Orientation*

Rearwards.

6.15.7. *Other requirements*

The illuminating surface of the retro-reflector may have parts in common with the apparent surface of any other lamp situated at the rear.

6.16. **Front retro-reflector, non-triangular**

6.16.1. *Presence*

Mandatory on trailers.

Mandatory on motor vehicles having all forward facing lamps with reflectors concealable.

Optional on other motor vehicles.

6.16.2. *Number*

Two, the performances of which shall conform to the requirements concerning Class IA or IB retro-reflectors in Regulation No 3. Additional retro-reflecting devices and materials (including two retro-reflectors not complying with paragraph 6.16.4 below), are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.

6.16.3. *Arrangement*

No special requirement.

6.16.4. *Position*

6.16.4.1. In width: that point on the illuminating surface which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

In the case of a trailer, the point of the illuminating surface which is farthest from the vehicle's median longitudinal plane shall not be farther than 150 mm from the extreme outer edge of the vehicle.

The distance between the inner edges of the two apparent surfaces in the direction of the reference axes shall:

For M_1 and N_1 category vehicles: have no special requirement;

For all other categories of vehicles: be not less than 600 mm. This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1 300 mm.

6.16.4.2. In height: above the ground, not less than 250 mm nor more than 900 mm (1 500 mm if the shape of the bodywork makes it impossible to keep within 900 mm).

6.16.4.3. In length: at the front of the vehicle.

6.16.5. *Geometric visibility*

Horizontal angle, 30° inwards and outwards. In the case of trailers, the angle inwards may be reduced to 10°. If because of the construction of the trailers this angle cannot be met by the mandatory retro-reflectors, then additional (supplementary) retro-reflectors shall be fitted, without the width limitation (paragraph 6.16.4.1), which shall, in conjunction with the mandatory retro-reflectors, give the necessary visibility angle.

Vertical angle: 10° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of a retro-reflector less than 750 mm above the ground.

6.16.6. *Orientation*

Towards the front.

6.16.7. *Other requirements*

The illuminating surface of the retro-reflector may have parts in common with the apparent surface of any other lamp situated at the front.

6.17. **Side retro-reflector, non-triangular**

6.17.1. *Presence*

Mandatory: On all motor vehicles the length of which exceeds 6 m.

On all trailers.

Optional: On motor vehicles the length of which does not exceed 6 m.

6.17.2. *Number*

Such that the requirements for longitudinal positioning are complied with. The performances of these devices shall conform to the requirements concerning Class IA or IB retro-reflectors in Regulation No 3. Additional retro-reflecting devices and materials (including two retro-reflectors not complying with paragraph 6.17.4), are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.

6.17.3. *Arrangement*

No special requirement.

6.17.4. *Position*

6.17.4.1. In width: no special requirement.

6.17.4.2. In height: above the ground, not less than 250 mm nor more than 900 mm (1 500 mm if the shape of the bodywork makes it impossible to keep within 900 mm).

6.17.4.3. In length: at least one side retro-reflector must be fitted to the middle third of the vehicle, the foremost side retro-reflector being not further than 3 m from the front; in the case of trailers, account shall be taken of the length of the drawbar for the measurement of this distance.

The distance between two adjacent side retro-reflectors shall not exceed 3 m. This does not, however, apply to M_1 and N_1 category vehicles.

If the structure of the vehicle makes it impossible to comply with such a requirement, this distance may be increased to 4 m. The distance between the rearmost side retro-reflector and the rear of the vehicle shall not exceed 1 m. However, for motor vehicles the length of which does not exceed 6 m, it is sufficient to have one side retro-reflector fitted within the first third and/or one within the last third of the vehicle length.

6.17.5. *Geometric visibility*

Horizontal angle: 45° to the front and to the rear.

Vertical angle: 10° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of a retro-reflector less than 750 mm above the ground.

6.17.6. *Orientation*

Towards the side.

6.17.7. *Other requirements*

The illuminating surface of the side retro-reflector may have parts in common with the apparent surface of any other side lamp.

6.18. **Side-marker lamps**

6.18.1. *Presence*

Mandatory: On all vehicles the length of which exceeds 6 m, except for chassis-cabs; the length of trailers shall be calculated including the drawbar. The SM1 type of side-marker lamp shall be used on all categories of vehicles; however the SM2 type of side-marker lamps may be used on the M_1 category of vehicles.

In addition, on M_1 and N_1 category vehicles less than 6 m in length, side-marker lamps shall be used, if they supplement the reduced geometric visibility requirements of front position lamps conforming to paragraph 6.9.5.2 and rear position lamps conforming to paragraph 6.10.5.2.

Optional:

On all other vehicles.

The SM1 or SM2 types of side-marker lamps may be used.

6.18.2. *Minimum number per side*

Such that the rules for longitudinal positioning are complied with.

6.18.3. *Arrangement*

No individual specifications.

6.18.4. *Position*

6.18.4.1. In width: no individual specifications.

6.18.4.2. In height: above the ground, not less than 250 mm nor more than 1 500 mm (2 100 mm if the shape of the bodywork makes it impossible to keep within 1 500 mm).

6.18.4.3. In length: at least one side-marker lamp must be fitted to the middle third of the vehicle, the foremost side-marker lamp being not further than 3 m from the front; in the case of trailers account shall be taken of the length of the drawbar for the measurement of this distance. The distance between two adjacent side-marker lamps shall not exceed 3 m. If the structure of the vehicle makes it impossible to comply with such a requirement, this distance may be increased to 4 m.

The distance between the rearmost side-marker lamp and the rear of the vehicle shall not exceed 1 m.

However, for vehicles the length of which does not exceed 6 m and for chassis-cabs, it is sufficient to have one side-marker lamp fitted within the first third and/or within the last third of the vehicle length.

6.18.5. *Geometric visibility*

Horizontal angle: 45° to the front and to the rear; however, for vehicles on which the installation of the side-marker lamps is optional this value can be reduced to 30°.

If the vehicle is equipped with side-marker lamps used to supplement the reduced geometric visibility of front and rear direction indicator lamps conforming to paragraph 6.5.5.2 and/or position lamps conforming to paragraphs 6.9.5.2 and 6.10.5.2, the angles are 45° towards the front and rear ends of the vehicle and 30° towards the centre of the vehicle (see the figure in paragraph 6.5.5.2).

Vertical angle: 10° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of a side-marker lamp less than 750 mm above the ground.

6.18.6. *Orientation*

Towards the side.

6.18.7. *Electrical connections*

On M_1 and N_1 category vehicles less than 6 m in length amber side-marker lamps may be wired to flash, provided that this flashing is in phase and at the same frequency with the direction indicator lamps at the same side of the vehicle.

For all other categories of vehicles: no individual specification.

6.18.8. *Tell-tale*

Tell-tale optional. If it exists its function shall be carried out by the tell-tale required for the front and rear position lamps.

6.18.9. *Other requirements*

When the rearmost side-marker lamp is combined with the rear position lamp reciprocally incorporated with the rear fog-lamp or stop lamp, the photometric characteristics of the side-marker lamp may be modified during the illumination of the rear fog lamp or stop lamp.

Rear side-marker lamps must be amber if they flash with the rear direction-indicator lamp.

6.19. **Daytime running lamp** [1]

6.19.1. *Presence*

Optional on motor vehicles. Prohibited on trailers.

6.19.2. *Number*

Two.

6.19.3. *Arrangement*

No special requirement.

6.19.4. *Position*

6.19.4.1. In width: that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

The distance between the inner edges of the apparent surfaces in the direction of the reference axes shall not be less than 600 mm.

This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1 300 mm.

6.19.4.2. In height: above the ground not less than 250 mm nor more than 1 500 mm.

6.19.4.3. In length: at the front of the vehicle. This requirement shall be deemed to be satisfied if the light emitted does not cause discomfort to the driver either directly, or indirectly through the rear-view mirrors and/or other reflecting surfaces of the vehicle.

6.19.5. *Geometric visibility*

Horizontal: outwards 20° and inwards 20°.

Vertical: upwards 10° and downwards 10°.

6.19.6. *Orientation*

Towards the front.

[1] The installation of this device may be forbidden on the basis of national regulations.

6.19.7. *Electrical connections*

If installed, the daytime running lamps shall be switched ON automatically when the device which starts and/or stops the engine is in a position which makes it possible for the engine to operate. It shall be possible to activate and deactivate the automatic switching ON of daytime running lamps without the use of tools. The daytime running lamp shall switch OFF automatically when the headlamps are switched ON, except when the latter are used to give intermittent luminous warnings at short intervals.

6.19.8. *Tell-tale*

Closed-circuit tell-tale optional.

6.19.9. *Other prescriptions*

None.

6.20. **Cornering lamp**

6.20.1. *Presence*

Optional on motor vehicles.

6.20.2. *Number*

Two.

6.20.3. *Arrangement*

No special requirement.

6.20.4. *Position*

6.20.4.1. In width: that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

6.20.4.2. In length: not further than 1 000 mm from the front.

6.20.4.3. In height:

minimum: Not less than 250 mm above the ground;

maximum: Not more than 900 mm above the ground.

However, no point on the apparent surface in the direction of the reference axis shall be higher than the highest point on the apparent surface in the direction of the reference axis of the dipped-beam headlamp.

6.20.5. *Geometric visibility*

Defined by angles α and β as specified in paragraph 2.13.:

α = 10° upwards and downwards,

β = 30° to 60° outwards.

6.20.6. *Orientation*

Such that the lamps meet the requirements for geometric visibility.

6.20.7. *Electrical connections*

The cornering lamps must be so connected that they cannot be activated unless the main-beam headlamps or the dipped-beam headlamps are switched ON at the same time.

The cornering lamp on one side of the vehicle may only be switched ON automatically when the direction indicators on the same side of the vehicle are switched ON and/or when the steering angle is changed from the straight-ahead position towards the same side of the vehicle.

The cornering lamp shall be switched OFF automatically when the direction indicator is switched OFF and/or the steering angle has returned in the straight-ahead position.

6.20.8. *Tell-tale*

None.

6.20.9. *Other requirements*

The cornering lamps shall not be activated at vehicle speeds above 40 km/h.

6.21. **Conspicuity markings**

6.21.1. *Presence*

6.21.1.1. Prohibited: on vehicles of categories M_1 and O_1.

6.21.1.2. Mandatory:

6.21.1.2.1. to the rear

full contour marking on vehicles exceeding 2 100 mm in width of the following categories:

(a) N_2 with a maximum mass exceeding 7,5 tonnes and N_3 (with the exception of chassis-cabs, incomplete vehicles and tractors for semi-trailers)

(b) O_3 and O_4

6.21.1.2.2. to the side:

6.21.1.2.2.1. partial contour marking on vehicles exceeding 6 000 mm in length (including the drawbar for trailers) of the following categories:

(a) N_2 with a maximum mass exceeding 7,5 tonnes and N_3 (with the exception of chassis-cabs, incomplete vehicles and tractors for semi-trailers)

(b) O_3 and O_4

6.21.1.2.3. However, where the shape, structure, design or operational requirements make it impossible to install the mandatory contour marking, a line marking may be installed.

6.21.1.3. Optional:

6.21.1.3.1. on all other categories of vehicles, not otherwise specified in paragraphs 6.21.1.1 and 6.21.1.2, including the cab of tractor units for semi-trailers and the cab of chassis-cabs.

6.21.1.3.2. partial or full contour marking may be applied instead of mandatory line markings, and full contour marking may be applied instead of mandatory partial contour marking.

6.21.2. *Number*

According to the presence.

6.21.3. *Arrangement*

The conspicuity markings shall be as close as practicable to horizontal and vertical, compatible with the shape, structure, design and operational requirements of the vehicle.

6.21.4. *Position*

6.21.4.1. Width

6.21.4.1.1. The conspicuity marking shall be as close as practicable to the edge of the vehicle.

6.21.4.1.2. The cumulative horizontal length of the conspicuity marking elements, as mounted on the vehicle, shall equate to at least 80 % of the overall width of the vehicle, excluding any horizontal overlap of individual elements.

6.21.4.1.3. However, if the manufacture can prove to the satisfaction of the authority responsible for type approval that it is impossible to achieve the value referred to in paragraph 6.21.4.1.2, the cumulative length may be reduced to 60 % and shall be indicated in the communication document and test report ([1]).

6.21.4.2. Length

6.21.4.2.1. The conspicuity marking shall be as close as practicable to the ends of the vehicle and reach to within 600 mm of each end of the vehicle (or cab in the case of tractor units for semi-trailers).

6.21.4.2.1.1. for motor vehicles, each end of the vehicle, or in the case of tractors for semi-trailers the each end of the cab;

6.21.4.2.1.2. for trailers, each end of the vehicle (excluding the drawbar).

6.21.4.2.2. The cumulative horizontal length of the conspicuity marking elements, as mounted on the vehicle, excluding any horizontal overlap of individual elements, shall equate to at least 80 % of:

6.21.4.2.2.1. for motor vehicles, the length of the vehicle excluding the cab, or in the case of tractors for semi-trailers, if fitted, the length of the cab;

6.21.4.2.2.2. for trailers, the length of the vehicle (excluding the drawbar).

6.21.4.2.3. However, if the manufacture can prove to the satisfaction of the authority responsible for type approval that it is impossible to achieve the value referred to in paragraph 6.21.4.2.2, the cumulative length may be reduced to 60 % and shall be indicated in the communication document and test report ([1]).

6.21.4.3. Height

6.21.4.3.1. Line markings and contour markings lower element(s):

As low as practicable within the range:

Minimum: not less than 250 mm above the ground.

Maximum: not more than 1 500 mm above the ground.

([1]) This provision does apply until five years after the official date of entry into force of the 03 series of amendments to this Regulation.

However, a maximum mounting height of 2 100 mm may be accepted where technical conditions prevent compliance with the maximum value of 1 500 mm or, if necessary, to fulfil the requirements of paragraphs 6.21.4.1.2, 6.21.4.1.3, 6.21.4.2.2 and 6.21.4.2.3 or the horizontal positioning of the line marking or the lower element(s) of the contour marking.

6.21.4.3.2. Contour markings upper element(s):

As high as practicable, but within 400 mm of the upper extremity of the vehicle.

6.21.5. *Visibility*

The conspicuity marking shall be considered visible, if at least 80 % of the illuminating surface of the marking is visible when viewed by an observer positioned at any point within the observation planes defined below:

6.21.5.1. for rear conspicuity markings (see Annex 11, Figure 1) the observation plane is perpendicular to the longitudinal axis of the vehicle situated 25 m from the extreme end of the vehicle and bounded by:

6.21.5.1.1. in height, by two horizontal planes 1 m and 3,0 m respectively above the ground,

6.21.5.1.2. in width, by two vertical planes which form an angle of 15° outwards from the vehicle's median longitudinal plane and which pass through the intersection of the vertical planes parallel to the vehicle's median longitudinal plane delimiting the vehicle's overall width, and the plane perpendicular to the longitudinal axis of the vehicle that delimits the end of the vehicle.

6.21.5.2. for side conspicuity markings (see Annex 11, figure 2) the observation plane is parallel to the longitudinal median plane of the vehicles situated 25 m from the extreme outer edge of the vehicle and bounded by:

6.21.5.2.1. in height, by two horizontal planes 1 m and 3,0 m respectively above the ground,

6.21.5.2.2. in width, by two vertical planes which form an angle of 15° outwards from a plane perpendicular to the vehicle's longitudinal axis and which pass through the intersection of the vertical planes perpendicular to the vehicle's longitudinal axis delimiting the vehicle's overall length and the extreme outer edge of the vehicle.

6.21.6. *Orientation*

6.21.6.1. To the side:

As close as practicable to being parallel to the median longitudinal plane of the vehicle, compatible with the shape, structure, design and operation requirements of the vehicle.

6.21.6.2. To the rear:

As close as practicable to being parallel to the transverse plane of the vehicle, compatible with the shape, structure, design and operation requirements of the vehicle.

6.21.7. *Other requirements*

6.21.7.1. Conspicuity markings shall be considered continuous if the distance between adjacent elements are as small as possible and do not exceed 50 % of the shortest adjacent element length.

6.21.7.2. In the case of a partial contour marking, each upper corner shall be described by two lines at 90° to each other and each at least 250 mm in length.

6.21.7.3. The distance between the conspicuity marking fitted to the rear of a vehicle and each mandatory stop lamp should be greater than 200 mm.

6.21.7.4. Where rear marking plates conforming to the 01 series of amendments to Regulation No 70 are installed these may be considered, the discretion of the manufacturer, part of the conspicuity marking to the rear, for the purposes of calculating the length of the conspicuity marking and its proximity to the side of the vehicle.

6.21.7.5. The locations on the vehicle designated for conspicuity markings shall allow for the installation of markings of at least 60 mm in width.

7. MODIFICATIONS AND EXTENSION OF APPROVAL OF THE VEHICLE TYPE OR OF THE INSTALLATION OF ITS LIGHTING AND LIGHT-SIGNALLING DEVICES

7.1. Every modification of the vehicle type, or of the installation of its lighting or light-signalling devices, or of the list referred to in paragraph 3.2.2, shall be notified to the Administrative Department which approved that vehicle type. The department may then either:

7.1.1. Consider that the modifications made are unlikely to have an appreciable adverse effect and that in any case the vehicle still meets the requirements; or

7.1.2. Require a further test report from the Technical Services responsible for conducting the tests.

7.2. Confirmation of extension or refusal of approval, specifying the alteration, shall be communicated by the procedure specified in paragraph 4.3 to the Parties to the Agreement applying this Regulation.

7.3. The Competent Authority issuing the extension of approval shall assign a series number for such an extension and inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

8. CONFORMITY OF PRODUCTION

The conformity of production procedures shall comply with those set out in the Agreement, Appendix 2 (E/ECE/324-E/ECE/TRANS/505/Rev.2), with the following requirements:

8.1. Any vehicle approved pursuant to this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set out in paragraphs 5 and 6.

8.2. The holder of the approval shall in particular:

8.2.1. ensure existence of procedures for effective quality control of the vehicle as regards all aspects relevant to compliance with the requirements set out in paragraphs 5 and 6;

8.2.2. ensure that for each type of vehicle at least the tests prescribed in Annex 9 to this Regulation or physical checks from which equivalent data may be derived are carried out;

8.3. The Competent Authority may carry out any test prescribed in this Regulation. These tests will be on samples selected at random without causing distortion of the manufacturers delivery commitments.

8.4. The Competent Authority shall strive to obtain a frequency of inspection of once per year. However, this is at the discretion of the Competent Authority and their confidence in the arrangements for ensuring effective control of the conformity of production. In the case where negative results are recorded, the Competent Authority shall ensure that all necessary steps are taken to re-establish the conformity of production as rapidly as possible.

9. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

9.1. The approval granted in respect of a type of vehicle pursuant to this Regulation may be withdrawn if the requirements are not complied with or if a vehicle bearing the approval mark does not conform to the type approved.

9.2. If a Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

10. PRODUCTION DEFINITELY DISCONTINUED

If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this Regulation, he shall inform the authority which granted the approval. Upon receiving the relevant communication, that authority shall inform thereof the other Parties to the Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

11. NAMES AND ADDRESSES OF TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS AND OF ADMINISTRATIVE DEPARTMENTS

The Parties to the 1958 Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Administrative Departments which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, issued in other countries, are to be sent.

12. TRANSITIONAL PROVISIONS

12.1. As from the official date of entry into force of the 03 series of amendments, no Contracting Party applying this Regulation shall refuse to grant approval under this Regulation as amended by the 03 series of amendments.

12.2. As from 12 months after the date of entry into force of the 03 series of amendments, Contracting Parties applying this Regulation shall grant approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by the 03 series of amendments.

12.3. Contracting Parties applying this Regulation shall not refuse to grant extensions of approval to the preceding series of amendments to this Regulation.

12.4. Contracting Parties applying this Regulation shall continue to grant approvals to those types of vehicles which comply with the requirements of this Regulation as amended by the preceding series of amendments during the 12 month period which follows the date of entry into force of the 03 series of amendments.

12.5. No Contracting Party applying this Regulation shall refuse national or regional type approval of a vehicle type approved to the 03 series of amendments to this Regulation.

12.6. Until 36 months after the date of entry into force of the 03 series of amendments to this Regulation, no Contracting Party applying this Regulation shall refuse national or regional type approval of a vehicle type approved to the preceding series of amendments to this Regulation.

12.7. Starting 36 months after the entry into force of the 03 series of amendments to this Regulation, Contracting Parties applying this Regulation may refuse first national or regional registration (first entry into service) of a vehicle which does not meet the requirements of the 03 series of amendments to this Regulation.

12.8. As from 60 months after the date of entry into force of the 03 series of amendments to this Regulation, approvals to this Regulation shall cease to be valid, except in the case of vehicle types which comply with the requirements of this Regulation as amended by the 03 series of amendments.

12.9. Notwithstanding the transitional provisions above, Contracting Parties whose application of this Regulation comes into force after the date of entry into force of the most recent series of amendments are not obliged to accept approvals which were granted in accordance with any of the preceding series of amendments to this Regulation.

12.10. Notwithstanding paragraph 12.7 or 12.8, approvals of the vehicle types to the preceding series of amendments to the Regulation which are not affected by the 03 series of amendments shall remain valid and Contracting Parties applying the Regulation shall continue to accept them.

12.11. Until the United Nations Secretary-General is notified otherwise, Japan declares that in relation to the installation of lighting the light signalling devices, Japan will only be bound by the obligations of the Agreement to which this Regulation is annexed with respect to vehicles of categories M_1 and N_1.

12.12. As from the date of entry into force of Supplement 7 to the 02 series of amendments, no Contracting Party applying this Regulation shall refuse to grant approvals under this Regulation as amended by Supplement 7 to the 02 series of amendments.

12.13. As from 30 months after the date of entry into force of Supplement 7 to the 02 series of amendments, Contracting Parties applying this Regulation shall grant ECE approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by Supplement 7 to the 02 series of amendments.

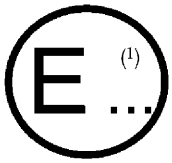
12.14. Contracting Parties applying this Regulation shall not refuse to grant extensions of approvals to the preceding series of amendments to this Regulation, including Supplement 6 to the 02 series of amendments.

12.15. ECE approvals granted under this Regulation before the date mentioned in paragraph 12.14, including extensions of such approvals, shall remain valid indefinitely.

ANNEX 1

COMMUNICATION

(Maximum format: A4 (210 × 297 mm))



issued by:

Name of administration:

.....

.....

.....

concerning (2):

APPROVAL GRANTED
APPROVAL EXTENDED
APPROVAL REFUSED
APPROVAL WITHDRAWN
PRODUCTION DEFINITELY DISCONTINUED

of a type of vehicle with regard to the installation of lighting and light-signalling devices, pursuant to Regulation No 48.

Approval No: ..... Extension No: .....

1. Trade name or mark of the vehicle: .....

2. Manufacturer's name for the type of vehicle: .....

3. Manufacturer's name and address: .....

4. If applicable, name and address of the manufacturer's representative: .....

5. Submitted for approval on: .....

6. Technical service responsible for conducting approval tests: .....

7. Date of test report: .....

8. Number of test report: .....

9. Concise description:

Lighting and light-signalling devices on the vehicle:

9.1. Main-beam headlamps: yes/no (2) .....

9.2. Dipped-beam headlamps: yes/no (2) .....

9.3. Front fog lamps: yes/no (2) .....

9.4. Reversing lamps: yes/no (2) .....

9.5. Front direction-indicators: yes/no (2) .....

9.6. Rear direction-indicators: yes/no (2) .....

9.7. Side direction-indicators: yes/no (2) .....

9.8. Hazard warning signal: yes/no (2) .....

9.9.	Stop lamps:	yes/no (2) .....
9.10.	Rear registration plate illuminating device:	yes/no (2) .....
9.11.	Front position lamps:	yes/no (2) .....
9.12.	Rear position lamps:	yes/no (2) .....
9.13.	Rear fog lamps:	yes/no (2) .....
9.14.	Parking lamps:	yes/no (2) .....
9.15.	End-outline marker lamps:	yes/no (2) .....
9.16.	Rear retro-reflectors, non-triangular:	yes/no (2) .....
9.17.	Rear retro-reflectors, triangular:	yes/no (2) .....
9.18.	Front retro-reflectors, non-triangular:	yes/no (2) .....
9.19.	Side retro-reflectors, non-triangular:	yes/no (2) .....
9.20.	Side marker lamps:	yes/no (2) .....
9.21.	Daytime running lamps:	yes/no (2) .....
9.22.	Cornering lamps:	yes/no (2) .....
9.23.	Conspicuity markings:	
9.23.1.	Full contour markings:	Rear yes/no (2) ..... Side yes/no (2) .....
9.23.2.	Partial contour markings:	Rear yes/no (2) ..... Side yes/no (2) .....
9.23.3.	Line markings:	Rear yes/no (2) ..... Side yes/no (2) .....
9.24.	Equivalent lamps:	yes/no (2) .....
9.25.	Maximum permissible load in the boot:	
10.	Comments	
10.1.	Any comments on movable components:	
10.2.	Method used for the definition of the apparent surface: boundary of the illuminating surface (2) or light-emitting surface (2)	
10.3.	Other comments (valid for right-hand or left-hand drive vehicles):	
10.4.	Comments regarding the extent of coverage of the conspicuity marking if it is less than the minimum value of 80 % required by paragraphs 6.21.4.1.2. and 6.21.4.2.2.	

11. Position of the approval mark: .....

12. Reason(s) for extension (if applicable): .....

13. Approval granted/extended/refused/withdrawn ([2])

14. Place: .....

15. Date: .....

16. Signature: .....

17. The following documents, bearing the approval number shown above, are available on request: .....

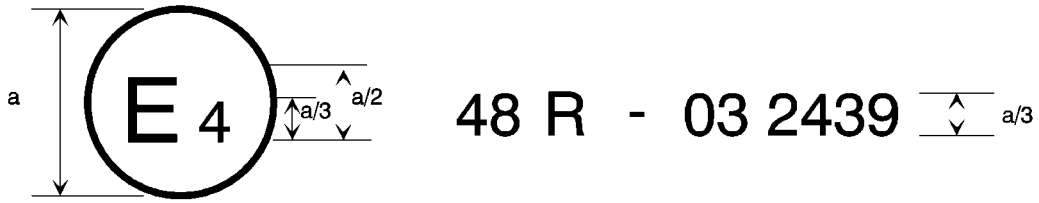
([1]) Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulation).
([2]) Strike out what does not apply, or repeat 'yes' or 'no'.

ANNEX 2

ARRANGEMENTS OF APPROVAL MARKS

Model A

(See paragraph 4.4 of this Regulation)

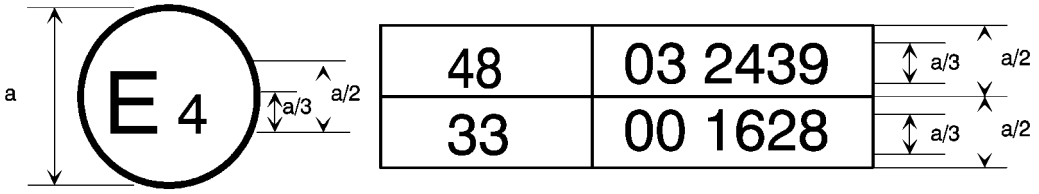


a = 8 mm min.

The above approval mark affixed to a vehicle shows that the vehicle type concerned has, with regard to the installation of lighting and light-signalling devices, been approved in the Netherlands (E4) pursuant to Regulation No 48 as amended by the 03 series of amendments. The approval number indicates that the approval was granted in accordance with the requirements of Regulation No 48 as amended by the 03 series of amendments.

Model B

(see paragraph 4.5 of this Regulation)



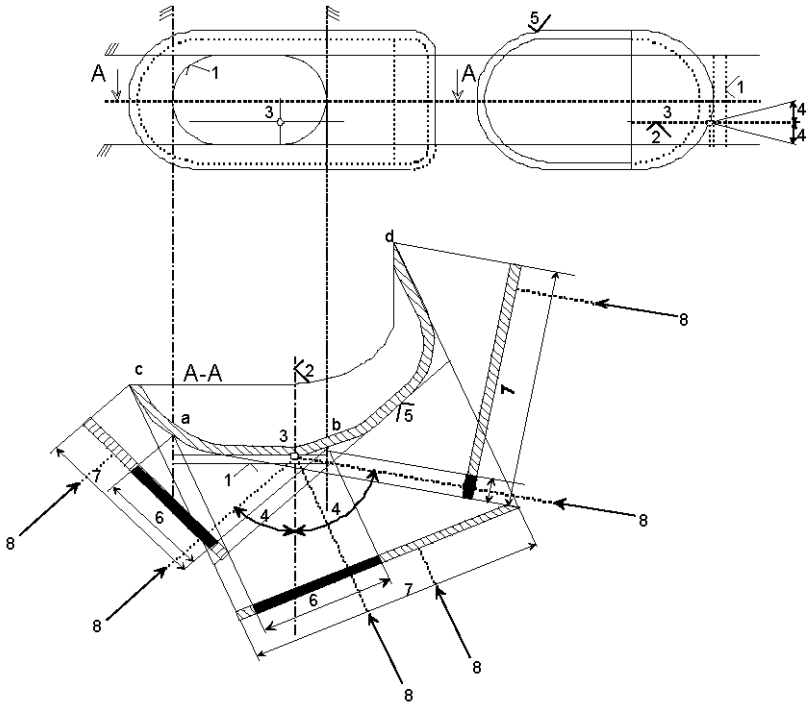
a = 8 mm min.

The above approval mark affixed to a vehicle shows that the vehicle type concerned has been approved in the Netherlands (E4) pursuant to Regulation No 48 as amended by the 03 series of amendments and Regulation No 33 ([1]). The approval number indicates that, at the dates when the respective approvals were given, Regulation No 48 was amended by the 03 series of amendments and Regulation No 33 was still in its original form.

([1]) The second number is given merely as an example.

ANNEX 3

LAMP SURFACES, AXIS AND CENTRE OF REFERENCE, AND ANGLES OF GEOMETRIC VISIBILITY



KEY

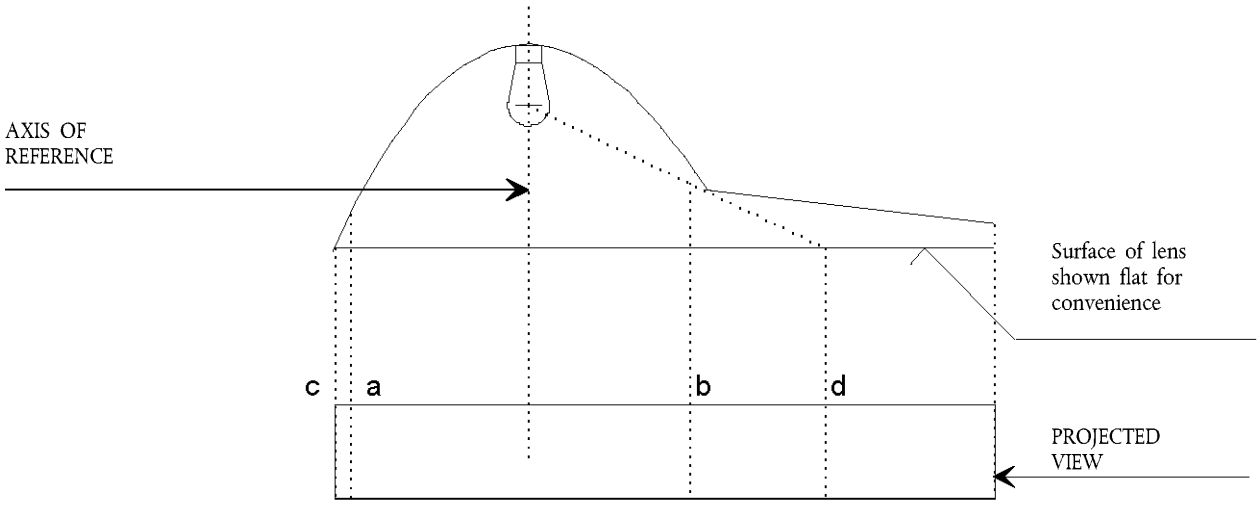
1. Illuminating surface
2. Axis of reference
3. Centre of reference
4. Angle of geometric visibility
5. Light-emitting surface
6. Apparent surface based on illuminating surface
7. Apparent surface based on light-emitting surface
8. Direction of visibility

Note: Notwithstanding the drawing, the apparent surface is to be considered as tangent to the light-emitting surface.

ILLUMINATING SURFACE IN COMPARISON WITH LIGHT-EMITTING SURFACE

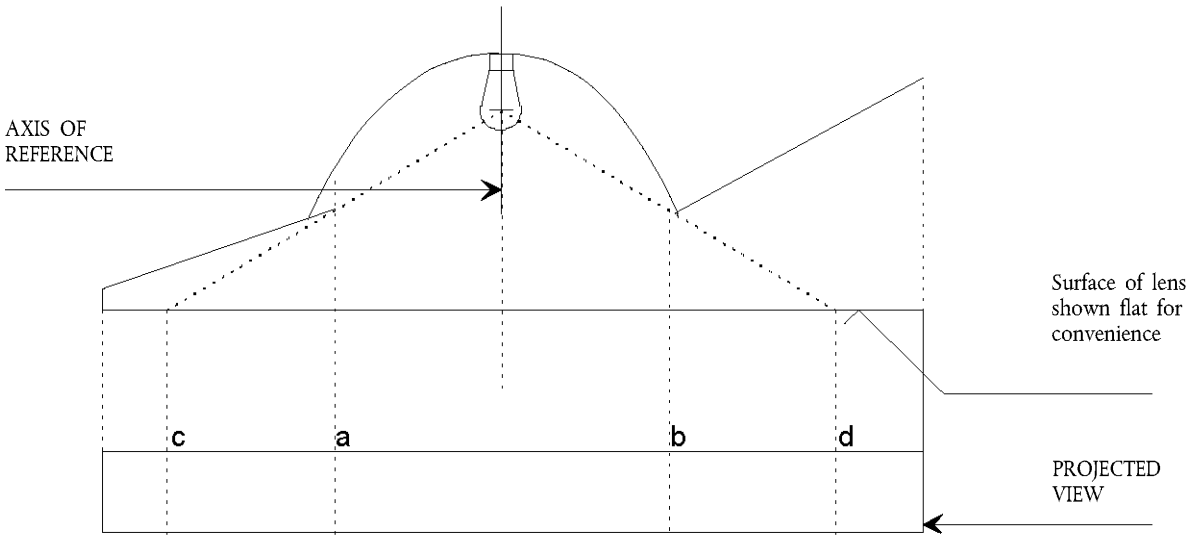
(See paragraphs 2.9 and 2.8 of this Regulation)

Sketch A



	Illuminating surface	Light-emitting surface
Edges are	a and b	c and d

Sketch B



	Illuminating surface	Light-emitting surface
Edges are	a and b	c and d

ANNEX 4

VISIBILITY OF A RED LAMP TO THE FRONT AND VISITBILITY OF A WHITE LAMP TO THE REAR

(See paragraphs 5.10.1 and 5.10.2 of this Regulation)

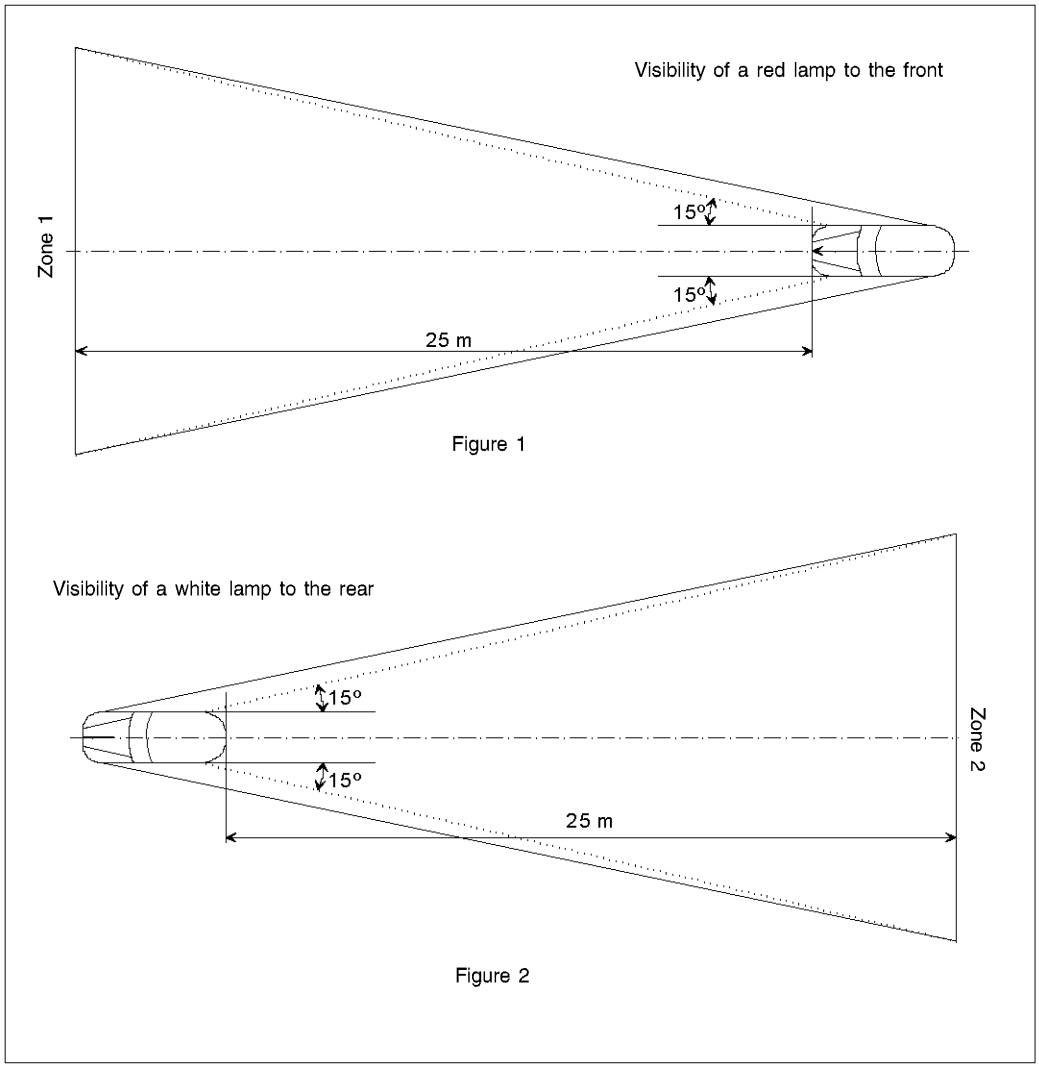


Figure 1

Figure 2

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 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 M_1 [1]:

2.1.1. The angle of the light beam 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. the driver, one passenger in the front seat farthest from the driver, all the seats farthest to the rear occupied;

2.1.1.4. all the seats occupied;

2.1.1.5. 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 a 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;

2.1.1.6. 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.

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

2.2. Vehicles in categories M_2 and M_3 [1];

The angle of the light beam from the dipped-beam headlamps must 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.

[1] As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3) Annex 7, (document TRANS/WP.29/78/Rev.1/Amend.2, as last amended by Amend.4).

2.3. Vehicles in category N with load surfaces:

2.3.1. The angle of the light beam from the dipped-beam headlamps must 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 % of the maximum permissible payload on the front axle. Conversely, the front axle is so considered when the load platform is at the front.

2.4. Vehicles in category N 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

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 condition No 1, as defined in Annex 5, for the category of vehicle under test. 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 % 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.

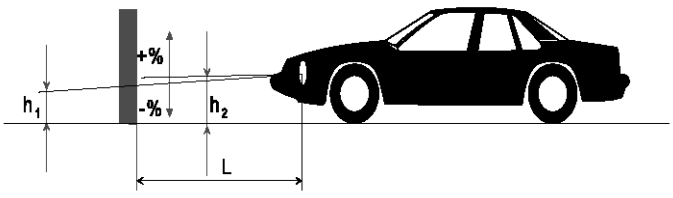


Figure 1

Dipped-beam downward inclination of a category M_1 vehicle

Notes:

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

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

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 % 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 % 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 must be filled to not less than 90 % of its capacity.

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.

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. The load shall be applied gradually without subjecting the vehicle to excessive shocks.

5.2. **Determination of the measured initial inclination**

The vehicle shall be prepared as specified in paragraph 4 and laden as specified in Annex 5 (first loading condition of the respective vehicle category). Before each measurement, the vehicle shall be rocked as specified in paragraph 5.4. Measurements shall be made three times.

5.2.1. If none of the three measured results differ by more than 2 mrad (0,2 % 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 % 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 % 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. *M_1 category vehicles with conventional suspension*

With the vehicle standing on the measuring site and, if necessary, with the wheels resting on floating platforms (which must 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 than 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. *M_2, M_3 and N category vehicles with conventional suspension*

5.4.2.1. If the treatment method for category M_1 vehicles described in paragraph 5.4.1 is not possible, the method described in paragraphs 5.4.2.2 or 5.4.2.3 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 in relation to the measured initial inclination determined in accordance with paragraph 5.2.

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).

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 % 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 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.

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 % 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 % 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.

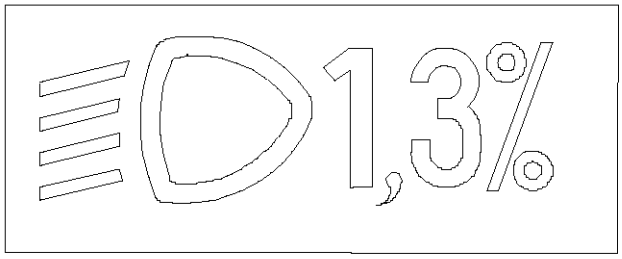
5.5.4. Requirements have been met, if, under all loading conditions, the variation between the measured initial inclination determined in accordance with paragraph 5.2 and the inclination measured under each loading condition is less than the values calculated in paragraph 5.5.1 (without safety margin).

5.5.5. 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 7

Indication of the stated initial adjustment referred to in paragraph 6.2.6.1.1 of this Regulation

Example



Standard symbol for dipped-beam headlamp

Value of the stated initial adjustment

The size of the symbol and characters is left to the discretion of the manufacturer.

ANNEX 8

The controls for the headlamp-levelling devices referred to in paragraph 6.2.6.2.2 of this Regulation

1. Specifications

1.1. Downward inclination of the dipped-beam must 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 counterclockwise 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 must 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).

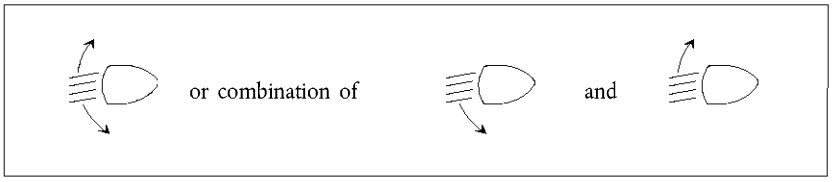
1.1.1. This control must carry symbols indicating clearly the movements corresponding to the downward and upward inclination of the dipped-beam.

1.2. The '0' position corresponds to the initial inclination according to paragraph 6.2.6.1.1. of this Regulation.

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

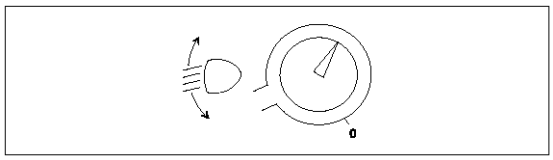
1.4. The marks used on control must be explained in the owner's handbook.

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

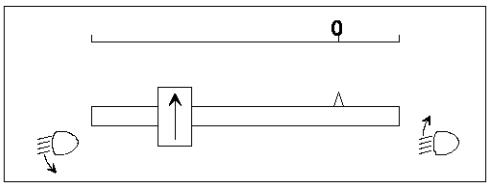


Symbols employing five lines instead of four may also be used

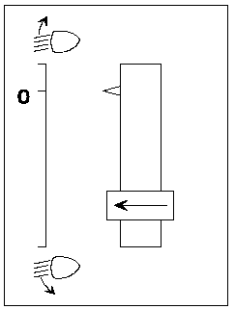
Example 1:



Example 2:



Example 3:



ANNEX 9

CONTROL OF CONFORMITY OF PRODUCTION

1. TESTS

1.1. **Position of lamps**

The position of lamps, as defined in paragraph 2.7 of this Regulation, in width, in height and in length shall be checked in accordance with the general requirements set out in paragraphs 2.8 to 2.10, 2.14 and 5.4 of this Regulation.

The values measured for the distances shall be such that the individual specifications applicable to each lamp are fulfilled.

1.2. **Visibility of lamps**

1.2.1. The angles of geometric visibility shall be checked in accordance with paragraph 2.13 of this Regulation.

The values measured for the angles shall be such that the individual specifications applicable to each lamp are fulfilled except that the limits of the angles may have an allowance corresponding to the ± 3° variation permitted in paragraph 5.3. for the mounting of the light-signalling devices.

1.2.2. The visibility of red light towards the front and of white light towards the rear shall be checked in accordance with paragraph 5.10 of this Regulation.

1.3. **Alignment of dipped-beam headlamps towards the front**

1.3.1. *Initial downward inclination*

The initial downward inclination of the cut-off of the dipped beam shall be set to the plated figure as required and shown in Annex 7.

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 and in particular paragraph 4.1.

1.3.2. *Variation of inclination with load*

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 % to 2,8 % for headlamp mounting height $h < 0,8$;

0,2 % to 2,8 % for headlamp mounting height $0,8 \leq h \leq 1,0$; or

0,7 % to 3,3 % (according to the aiming range chosen by the manufacturer at the approval);

0,7 % to 3,3 % for headlamp mounting height $1,0 < h \leq 1,2$ m;

1,2 % to 3,8 % for headlamp mounting height $h > 1,2$ m.

The states of loading to be used shall be as follows, as indicated in Annex 5 to this Regulation, for every system adjusted accordingly.

1.3.2.1. Vehicles in category M_1:

Paragraph 2.1.1.1.

Paragraph 2.1.1.6 taking into account

Paragraph 2.1.2.

1.3.2.2. Vehicles in category M_2 and M_3:

Paragraph 2.2.1.

Paragraph 2.2.2.

1.3.2.3. Vehicles in category N with load surfaces:

Paragraph 2.3.1.1.

Paragraph 2.3.1.2.

1.3.2.4. Vehicles in category N without load surfaces:

1.3.2.4.1. Drawing vehicles for semi-trailers:

Paragraph 2.4.1.1.

Paragraph 2.4.1.2.

1.3.2.4.2. Drawing vehicles for trailers:

Paragraph 2.4.2.1.

Paragraph 2.4.2.2.

1.4. **Electrical connections and telltales**

The electrical connections shall be checked by switching on every lamp supplied by the electrical system of the vehicle.

The lamps and telltales shall function in accordance with the provisions set out in paragraphs 5.11 to 5.14 of this Regulation and with the individual specifications applicable to each lamp.

1.5. **Light intensities**

1.5.1. *Main-beam headlamps*

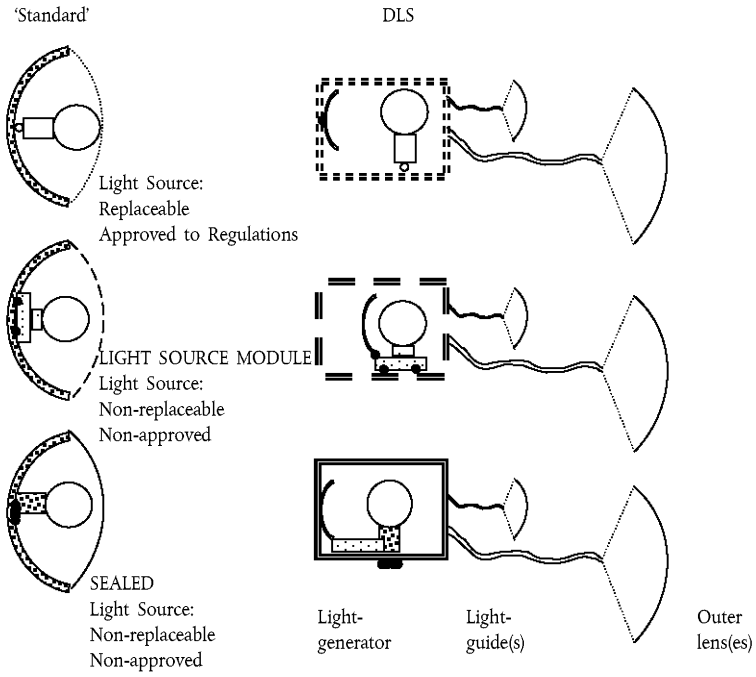
The aggregate maximum intensity of the main beam headlamps shall be checked by the procedure described in paragraph 6.1.9.2 to this Regulation. The value obtained shall be such that the requirement in paragraph 6.1.9.1 of this Regulation is fulfilled.

1.6. The presence, number, colour, arrangement and, where applicable, the category of lamps shall be checked by visual inspection of the lamps and their markings.

These shall be such that the requirements set out in paragraphs 5.15 and 5.16 as well as in the individual specifications applicable to each lamp are fulfilled.

ANNEX 10

EXAMPLES OF LIGHT SOURCE OPTIONS



ANNEX 11

VISIBILITY OF CONSPICUITY MARKINGS TO THE REAR AND SIDE OF A VEHICLE

(see paragraph 6.21.5 of this Regulation)

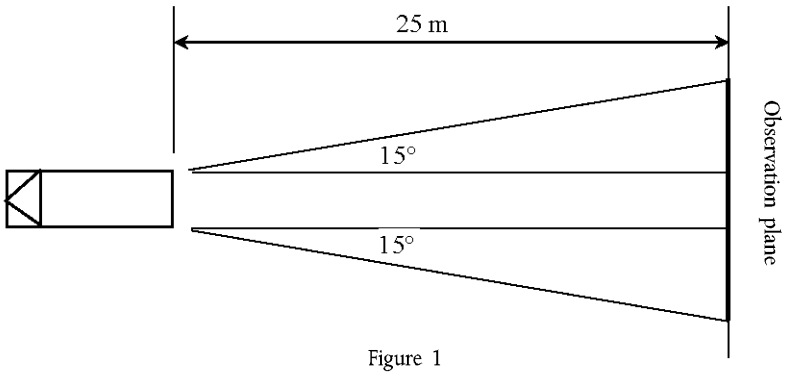


Figure 1

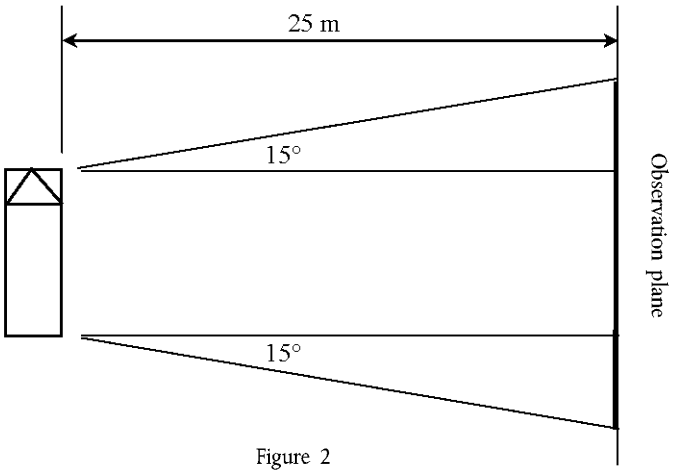


Figure 2

Regulation No 51 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of motor vehicles having at least four wheels with regard to their noise emissions

Addendum 50: Regulation No 51

Revision 1

Incorporating all valid text up to:

Supplement 5 to the 02 series of amendments — Date of entry into force: 18 June 2007

CONTENTS

REGULATION

1. Scope
2. Definitions
3. Application for approval
4. Markings
5. Approval
6. Specifications
7. Modification and extension of approval of a vehicle type
8. Conformity of production
9. Penalties for non-conformity of production
10. Production definitely discontinued
11. Transitional provisions
12. Names and addresses of technical services responsible for conducting approval tests, and of administrative departments

ANNEXES

Annex 1 Communication concerning the approval or extension or refusal or withrawal of approval or production definitely discontinued of a vehicle type with regard to its noise emission pursuant to Regulation No 51

Annex 2 Arrangements of the approval mark

Annex 3 Methods and instruments for measuring the noise made by motor vehicles (Measurement Method A)

Annex 4 Classification of vehicles

Annex 5 Exhaust systems containing fibrous materials

Annex 6 Compressed air noise

Annex 7 Checks on conformity of production

Annex 8 Specifications for the test site

Annex 9 Vehicle Test Data pursuant to Measurement Method B

Annex 10 Methods and instruments for measuring the noise made by motor vehicles (Measurement Method B)

1. SCOPE

This Regulation applies to vehicles of category M and N [1] with regard to noise.

2. DEFINITIONS

For the purpose of this Regulation,

2.1. 'Approval of a vehicle' means the approval of a vehicle type with regard to noise;

2.2. 'Vehicle type' means a category of motor vehicles which do not differ in such essential respects as:

2.2.1. the shape or materials of the bodywork (particularly the engine compartment and its sound-proofing);

2.2.2. the length and width of the vehicle;

2.2.3. the type of engine (positive or compression ignition, two- or four-stroke, reciprocating or rotary piston), number and capacity of cylinders, number and type of carburettors or injection system, arrangement of valves, rated maximum power and corresponding engine speed(s), or the type of electric motor;

2.2.4. the transmission system, the number of gears and ratios;

2.2.5. the noise reduction system as defined in the following paragraphs 2.3 and 2.4.

2.2.6. Notwithstanding the provisions of paragraphs 2.2.2 and 2.2.4, vehicles other than those in categories M_1 and N_1 [1] having the same type of engine and/or different overall gear ratios, may be regarded as vehicles of the same type.

However, if the above differences provide for a different test method, these differences are to be considered as a change of type.

2.3. 'Noise reduction system' means a complete set of components necessary for limiting the noise made by a motor vehicle and its exhaust;

2.4. 'Noise reduction systems of different types' means noise reduction systems which differ in such essential respects as:

2.4.1. that their components as specified in paragraph 4.1, bear different trade names or marks;

2.4.2. that the characteristics of the materials constituting a component are different or that the components differ in shape or size, a change in the plating procedure (galvanisation, aluminium coating, etc.) is not deemed to produce a difference of type;

2.4.3. that the operating principles of at least one component are different;

2.4.4. that their components are assembled differently;

2.4.5. that the number of the intake and/or exhaust silencers is different.

[1] As defined in Annex 7 to the Consolidated Resolution on the Construction of Vehicles (R.E.3) (TRANS/WP.29/78/Rev.1/Amend.2 as last amended by its Amendment 4).

2.5. 'Noise reduction system component' means one of the individual constituent parts whose assembly constitutes the noise reduction system.

These components are, in particular: the exhaust piping(s), the expansion chamber(s), the silencer(s) proper.

2.5.1. The air filter is considered as a component only if its presence is essential to ensure observance of the prescribed soundlevel limits.

2.5.2. Manifolds are not considered components of the noise reduction system.

2.6. 'Maximum mass' means the technically permissible maximum mass declared by the vehicle manufacturer (this mass may be greater than the maximum mass authorised by the national administration).

2.7. '(Rated) engine power' means the engine power expressed in kW (ECE) and measured by the ECE method pursuant to Regulation No 85.

2.8. 'Mass of a vehicle in running order (m_{ro})' means the mass of an unladen vehicle with bodywork, and with coupling device in the case of a towing vehicle, or the mass of the chassis with cab if the manufacturer does not fit the bodywork and/or coupling device, including coolant, oils, 90 % of fuel, 100 % of other liquids except used waters, tools, spare wheel, driver (75 kg) and, for buses and coaches, the mass of the crew member (75 kg) if there is a crew seat in the vehicle.

2.9. 'Rated engine speed, *S*' means the declared engine speed in min^{-1} (rpm) at which the engine develops its rated maximum net power pursuant to Regulation No 85.

If the rated maximum net power is reached at several engine speeds, the highest engine speed shall be used.

2.10. 'Power to mass ratio index (PMR)' means a numerical quantity (see Annex 10 paragraph 3.1.2.1.1) with no dimension used for the calculation of acceleration.

2.11. 'Reference point' means a point which is defined as follows:

2.11.1. Category M_1, N_1:

— for front engine vehicles: the front end of the vehicle;

— for mid engine vehicles: the centre of the vehicle;

— for rear engine vehicles: the rear end of the vehicle.

2.11.2. Category M_2, M_3, N_2, N_3:

the border of the engine closest to the front of the vehicle.

2.12. 'Engine' means the power source without detachable accessories.

2.13. 'Target acceleration' means an acceleration at a partial throttle condition in urban traffic and is derived from statistical investigations.

2.14. 'Reference acceleration' means the required acceleration during the acceleration test on the test track.

2.15. 'Gear ratio weighting factor k' means a dimensionless numerical quantity used to combine the test results of two gear ratios for the acceleration test and the constant speed test.

2.16. 'Partial power factor k_p' means a numerical quantity with no dimension used for the weighted combination of the test results of the acceleration test and the constant speed test for vehicles.

2.17. 'Pre-acceleration' means application of acceleration control device prior to AA' for the purpose of achieving stable acceleration between AA' and BB'.

2.18. 'Locked gear ratios' means the control of transmission such that the transmission gear cannot change during a test.

3. APPLICATION FOR APPROVAL

3.1. The application for approval of a vehicle type with regard to noise shall be submitted by its manufacturer or by his duly accredited representative.

3.2. It shall be accompanied by the undermentioned documents and the following particulars in triplicate:

3.2.1. a description of the vehicle type with regard to the items mentioned in paragraph 2.2. The numbers and/or symbols identifying the engine type and the vehicle type shall be specified;

3.2.2. a list of the components, duly identified, constituting the noise reduction system;

3.2.3. a drawing of the assembled noise reduction system and an indication of its position on the vehicle;

3.2.4. detailed drawings of each component to enable it to be easily located and identified, and a specification of the materials used.

3.3. In the case of paragraph 2.2.6 the single vehicle, representative of the type in question, will be selected by the technical service conducting approval tests, in accordance with the vehicle manufacturer, as that with the lowest mass in running order with the shortest length and following the specification laid down in paragraph 3.1.2.3.2.3 in Annex 3.

3.4. At the request of the technical service conducting approval tests, the vehicle manufacturer shall, in addition, submit a sample of the noise reduction system and an engine of at least the same cylinder capacity and rated maximum power as that fitted to the vehicle in respect of which typeapproval is sought.

3.5. The competent authority shall verify the existence of satisfactory arrangements for ensuring effective control of the conformity of production before type approval is granted.

4. MARKINGS

4.1. The components of the noise reduction system, excluding fixing hardware and piping, shall bear:

4.1.1. the trade name or mark of the manufacturer of the noise reduction system and of its components; and

4.1.2. the manufacturer's trade description;

4.2. These markings shall be clearly legible and be indelible even after fitting.

4.3. A component may carry several approval numbers if it has been approved as a component of several replacement silencing systems.

5. APPROVAL

5.1. Type approval shall only be granted if,

(a) the vehicle type meets the requirements of paragraphs 6 and 7 when tested according to measurement method A of Annex 3, and

(b) starting at 1 July 2007 and for a maximum period of two years, the results of the test run of that vehicle type in accordance with the measurement method B of Annex 10 have been added to the test report in Annex 9 and communicated to the European Commission and those Contracting Parties that express an interest in receiving the data. This does not include any tests done in connection with the extension of existing approvals according to Regulation No 51. Furthermore, for the purpose of this monitoring procedure a vehicle is not considered to be a new type if the vehicle differs only in respect to paragraphs 2.2.1 and 2.2.2.

5.2. An approval number shall be assigned to each type approved. Its first two digits (at present 02 corresponding to the 02 series of amendments which entered into force on 18 April 1995) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party may not assign the same number to the same vehicle type equipped with another type of noise reduction system or to another vehicle type.

5.3. Notice of approval or of extension or of refusal or withdrawal of approval or of production definitely discontinued of a vehicle type pursuant to this Regulation shall be communicated to the Parties to the Agreement applying this Regulation, by means of a form conforming to the model in Annex 1 to this Regulation.

5.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation an international approval mark consisting of:

5.4.1. a circle surrounding the letter 'E' followed by the distinguishing number of the country which has granted approval [1];

5.4.2. the number of this Regulation, followed by the letter 'R', a dash and the approval number to the right of the circle prescribed in paragraph 5.4.1.

[1] 1 for Germany, 2 for France, 3 for Italy, 4 for the Netherlands, 5 for Sweden, 6 for Belgium, 7 for Hungary, 8 for the Czech Republic, 9 for Spain, 10 for Yugoslavia, 11 for the United Kingdom, 12 for Austria, 13 for Luxembourg, 14 for Switzerland, 15 (vacant), 16 for Norway, 17 for Finland, 18 for Denmark, 19 for Romania, 20 for Poland, 21 for Portugal, 22 for the Russian Federation, 23 for Greece, 24 for Ireland, 25 for Croatia, 26 for Slovenia, 27 for Slovakia, 28 for Belarus, 29 for Estonia, 30 (vacant), 31 for Bosnia and Herzegovina, 32 for Latvia, 33 (vacant), 34 for Bulgaria, 35-36 (vacant), 37 for Turkey, 38-39 (vacant), 40 for the former Yugoslav Republic of Macedonia, 41 (vacant), 42 for the European Community (Approvals are granted by its Member States using their respective ECE symbol), 43 for Japan, 44 (vacant), 45 for Australia, 46 for Ukraine and 47 for South Africa. Subsequent numbers shall be assigned to other countries in the chronological order in which they ratify or accede to the Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, and the numbers thus assigned shall be communicated by the Secretary-General of the United Nations to the Contracting Parties to the Agreement.

5.5. If the vehicle conforms to a vehicle type approved, under one or more other Regulations annexed to the Agreement, in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 5.4.1 need not be repeated; in such a case the regulation and approval numbers and the additional symbols of all the Regulations under which approval has been granted in the country which has granted approval under this Regulation shall be placed in vertical columns to the right of the symbol prescribed in paragraph 5.4.1.

5.6. The approval mark shall be clearly legible and be indelible.

5.7. The approval mark shall be placed close to or on the vehicle data plate affixed by the manufacturer.

5.8. Annex 2 to this Regulation gives examples of arrangements of the approval mark.

6. SPECIFICATIONS

6.1. **General specifications**

6.1.1. The vehicle, its engine and its noise reduction system shall be so designed, constructed and assembled as to enable the vehicle, in normal use, despite the vibration to which it may be subjected, to comply with the provisions of this Regulation.

6.1.2. The noise reduction system shall be so designed, constructed and assembled as to be able to reasonably resist the corrosive phenomena to which it is exposed having regard to the conditions of use of the vehicle.

6.2. **Specifications regarding sound levels**

6.2.1. *Methods of measurement*

6.2.1.1. The noise made by the vehicle type submitted for approval shall be measured by the two methods described in Annex 3 to this Regulation for the vehicle in motion and for the vehicle when stationary ([1]); in the case of a vehicle powered by an electric motor, the emitted noise shall only be measured in motion.

Vehicles having a maximum permissible mass exceeding 2 800 kg must be subjected to an additional measurement of the compressed air noise with the vehicle stationary in accordance with the specifications of Annex 6, if corresponding brake equipment is part of the vehicle.

6.2.1.2. The two values measured in accordance with the provisions of paragraph 6.2.1.1 shall be entered in the test report and on a form conforming to the model in Annex 1 to this Regulation.

The values measured as specified in paragraph 6.2.1.1 must be recorded in a test report and a certificate corresponding to the model shown in Annex 1.

6.2.2. *Sound level limits*

6.2.2.1. Subject to the provisions of paragraph 6.2.2.2, the sound level of vehicle types, as measured by the method described in paragraph 3.1 of Annex 3 to this Regulation, shall not exceed the following limits:

([1]) A test is made on a stationary vehicle in order to provide a reference value for administrations which use this method to check vehicles in use.

Vehicle categories		Limit values (dB(A))
6.2.2.1.1.	Vehicles used for the carriage of passengers and capable of having not more than nine seats, including the driver's seat	74
6.2.2.1.2.	Vehicles used for the carriage of passengers having more than nine seats, including the driver's seat, and a maximum authorised mass of more than 3,5 tonnes	
6.2.2.1.2.1.	with an engine power less than 150 kW (ECE)	78
6.2.2.1.2.2.	with an engine power of 150 kW (ECE) or above	80
6.2.2.1.3.	Vehicles used for the carriage of passengers having more than nine seats, including the driver's seat; vehicles used for the carriage of goods	
6.2.2.1.3.1.	with a maximum authorised mass not exceeding 2 tonnes	76
6.2.2.1.3.2.	with a maximum authorised mass greater than 2 tonnes but not exceeding 3,5 tonnes	77
6.2.2.1.4.	Vehicles used for the transport of goods with a maximum authorised mass exceeding 3,5 tonnes	
6.2.2.1.4.1.	with an engine power less than 75 kW (ECE)	77
6.2.2.1.4.2.	with an engine power of 75 kW (ECE) or above but less than 150 kW (ECE)	78
6.2.2.1.4.3.	with an engine power of 150 kW (ECE) or above	80

6.2.2.2. However,

6.2.2.2.1. For the vehicle types mentioned in paragraphs 6.2.2.1.1 and 6.2.2.1.3 equipped with a compression-ignition and direct-injection internal combustion engine, the limit values shall be increased by 1 dB(A);

6.2.2.2.2. For vehicle types designed for off-road [1] use and with a maximum authorised mass above 2 tonnes, the limit values shall be increased:

6.2.2.2.2.1. by 1 dB(A) if they are equipped with an engine having a power of less than 150 kW (ECE);

6.2.2.2.2.2. by 2 dB(A) if they are equipped with an engine having a power of 150 kW (ECE) or above.

6.2.2.2.3. For vehicle types mentioned in paragraph 6.2.2.1.1 fitted with a gear box having more than four forward gears and equipped with an engine developing a maximum power greater than 140 kW (ECE) and having a maximum-power/maximum-mass ratio greater than 75 kW/t, the limit values shall be increased by 1 dB(A), if the speed at which the rear of the vehicle passes the line BB' in third gear is greater than 61 km/h.

6.3. **Specifications regarding exhaust systems containing fibrous materials**

6.3.1. Requirements of Annex 5 shall be applied.

7. MODIFICATION AND EXTENSION OF APPROVAL OF A VEHICLE TYPE

7.1. Every modification of the vehicle type shall be notified to the administrative department which approved the vehicle type. The department may then either:

7.1.1. Consider that the modifications made are unlikely to have an appreciable adverse effect and that in any case the vehicle still complies with the requirements, or

[1] In conformity with the definitions given in the Consolidated Resolution on the Construction of Vehicles (R.E.3) (TRANS/WP.29/78/Rev.1/Amend.2, Annex 7/Rev.2).

7.1.2. Require a further test report from the technical service responsible for conducting the tests.

7.2. Confirmation or refusal of approval, specifying the alterations shall be communicated by the procedure specified in paragraph 5.3 to the Parties to the Agreement applying this Regulation.

7.3. The competent authority issuing the extension of approval shall assign a series number for such an extension and inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

8. CONFORMITY OF PRODUCTION

8.1. Vehicles approved to this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set forth in paragraph 6.

8.2. In order to verify that the requirements of paragraph 8.1 are met, suitable controls of the production shall be carried out.

8.3. The holder of the approval shall in particular

8.3.1. ensure existence of procedures for the effective control of the quality of products;

8.3.2. have access to the control equipment necessary for checking the conformity of each approved type;

8.3.3. ensure that data of test results are recorded and that Annexed documents shall remain available for a period to be determined in accordance with the administrative service;

8.3.4. analyse the results of each type of test, in order to verify and ensure the stability of the product characteristics making allowance for variation of an industrial production;

8.3.5. ensure that for each type of product at least the tests prescribed in Annex 7 to this Regulation are carried out;

8.3.6. ensure that any sampling or test pieces giving evidence of non-conformity with the type of test considered shall give rise to another sampling and another test. All the necessary steps shall be taken to re-establish the conformity of the corresponding production.

8.4. The competent authority which has granted typeapproval may at any time verify the conformity control method applicable to each production unit.

8.4.1. In every inspection the test books and production survey records shall be presented to the visiting inspector.

8.4.2. The inspector may take samples at random which will be tested in the manufacturer's laboratory. The minimum number of samples may be determined according to the results of the manufacturer's own verification.

8.4.3. When the quality level appears unsatisfactory or when it seems necessary to verify the validity of the tests carried out in application of paragraph 8.4.2 the inspector shall select samples to be sent to the technical service which has conducted the type approval tests.

8.4.4. The competent authority may carry out any test prescribed in this Regulation.

8.4.5. The normal frequency of inspections by the competent authority shall be once every two years. If unsatisfactory results are recorded during one of these visits, the competent authority shall ensure that all necessary steps are taken to re-establish the conformity of production as rapidly as possible.

9. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

9.1. The approval granted in respect of a vehicle type pursuant to this Regulation may be withdrawn if the requirements set forth above are not met.

9.2. If a Contracting Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a communication form conforming to the model in Annex 1 to this Regulation.

10. PRODUCTION DEFINITELY DISCONTINUED

10.1. If the holder of the approval completely ceases to manufacture a vehicle type approved in accordance with this Regulation, he shall so inform the authority which granted the approval. Upon receiving the relevant communication that authority shall inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

11. TRANSITIONAL PROVISIONS

11.1. As from the official date of entry into force of the 02 series of amendments, no Contracting Party applying this Regulation shall refuse to grant ECE approval under this Regulation as amended by the 02 series of amendments.

11.2. As from 1 October 1995, Contracting Parties applying this Regulation shall grant ECE approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by the 02 series of amendments.

11.3. As from 1 October 1996, Contracting Parties applying this Regulation may refuse first national registration (first entry into service) of a vehicle which does not meet the requirements of the 02 series of amendments to this Regulation.

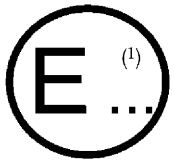
12. NAMES AND ADDRESSES OF TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS AND OF ADMINISTRATIVE DEPARTMENTS

The Parties to the 1958 Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the technical services responsible for conducting approval tests and of the administrative departments which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, issued in other countries, are to be sent.

ANNEX 1

COMMUNICATION

(Maximum format: A4 (210 × 297 mm))



issued by:

Name of administration:

.....

.....

.....

concerning (2):

APPROVAL GRANTED
APPROVAL EXTENDED
APPROVAL REFUSED
APPROVAL WITHDRAWN
PRODUCTION DEFINITELY DISCONTINUED

of a vehicle type with regard to its noise emission pursuant to ECE Regulation No 51.

Approval No: ..... Extension No: .....

1. Trade name or mark of the vehicle: .....

2. Vehicle type: .....

2.1. Maximum permissible mass including semi-trailer (where applicable): .....

3. Manufacturer's name and address: .....

4. If applicable, name and address of manufacturer's representative: .....

5. Engine:

5.1. Manufacturer: .....

5.2. Type: .....

5.3. Model: .....

5.4. Rated maximum power (ECE): ..... kW at ..... rev/min.

5.5. Kind of engine: e.g. positive-ignition, compression-ignition, etc. (3): .....

5.6. Cycles: two-stroke or four-stroke (if applicable) .....

5.7. Cylinder capacity (if applicable) .....

6. Transmission: non-automatic gearbox/automatic gearbox (2) .....

6.1. Number of gears .....

7. Equipment:

7.1. Exhaust silencer: .....

7.1.1. Manufacturer or authorised representative (if any): .....

7.1.2. Model: .....

7.1.3. Type: ..... in accordance with drawing No: .....

7.2. Intake silencer: .....

7.2.1. Manufacturer or authorised representative (if any): .....

7.2.2. Model: .....

7.2.3. Type: ..... in accordance with drawing No: .....

7.3. Tyre size (by axle): .....

8. Measurements:

8.1. Sound level of moving vehicle:

	Measurement results		
	Lefthand side dB(A) (4)	Righthand side dB(A) (4)	Position of gear lever
First measurement			
Second measurement			
Third measurement			
Fourth measurement			

Test result: ..... dB(A)

8.2. Sound level of stationary vehicle:

Position and orientation of microphone (according to diagrams in appendix of Annex 3)

	Measurement results	
	dB(A)	Engine speed
First measurement		
Second measurement		
Third measurement		

Test result: ..... dB(A)

8.3. Sound level of compressed air noise:

	Measurement results	
	Lefthand side dB(A) (4)	Righthand side dB(A) (4)
First measurement		
Second measurement		
Third measurement		
Fourth measurement		

Test result: ..... dB(A)

8.4. Ambient conditions

8.4.1. Test site (surface characteristics): .....

8.4.2. Temperatures (in °C): .....

8.4.2.1. Temperature of ambient air: .....

8.4.2.2. Temperature of test track surface: .....

8.4.3. Atmospheric pressure (kPa): .....

8.4.4. Humidity (%): .....

8.4.5. Wind speed (km/h): .....

8.4.6. Wind direction: .....

8.4.7. Background noise (dB(A)): .....

9. Vehicle submitted for approval on: .....

10. Technical service responsible for typeapproval tests: .....

11. Date of test report issued by that service: .....

12. Number of test report issued by that service: .....

13. Typeapproval in respect of sound levels is hereby granted/extended/refused/withdrawn (2)

14. Position of approval mark on the vehicle: .....

15. Place: .....

16. Date: .....

17. Signature: .....

18. The following documents, bearing the approval number shown above, are Annexed to this communication:

drawings, diagrams and plans of the engine and of the noise reduction system;

photographs of the engine and of the noise reduction system;

list of components, duly identified constituting the noise reduction system.

19. Remarks:

.....

.....

.....

(1) Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulations).
(2) Strike out what does not apply.
(3) If a non-conventional engine is used, this should be stated.
(4) The measurement values are given with the 1 dB(A) deduction in accordance with the provisions of paragraph 6.2.2.1.

ANNEX 2

ARRANGEMENTS OF THE APPROVAL MARK

Model A

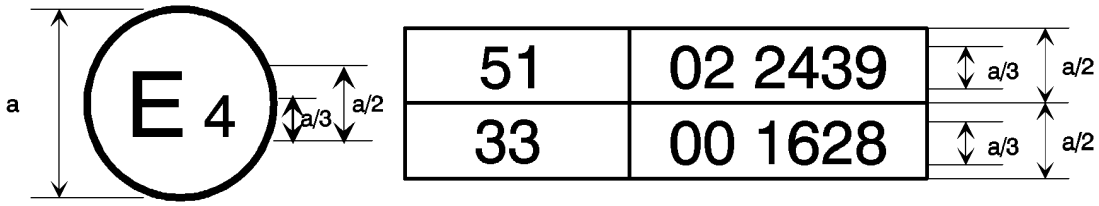
(See paragraph 5.4 of this Regulation)

a = 8 mm min.

The above approval mark affixed to a vehicle shows that the vehicle type concerned has, with regard to its noise emission, been approved in the Netherlands (E 4) pursuant to Regulation No 51 under approval No 022439. The first two digits of the approval number indicate that Regulation No 51 already included the 02 series of amendments when the approval was granted.

Model B

(See paragraph 5.5 of this Regulation)



a = 8 mm min.

The above approval mark affixed to a vehicle shows that the vehicle type concerned has been approved in the Netherlands (E 4) pursuant to Regulations Nos 51 and 33 [1]. The approval numbers indicate that, at the dates when the respective approvals were granted, Regulation No 51 included the 02 series of amendments while Regulation No 33 was in its original form.

[1] The latter number is given as an example only.

ANNEX 3

METHODS AND INSTRUMENTS FOR MEASURING THE NOISE MADE BY MOTOR VEHICLES

1. MEASURING INSTRUMENTS

1.1. **Acoustic measurements**

The sound level meter or the equivalent measuring system, including the windscreen recommended by the manufacturer shall at least meet the requirements of Type 1 instruments in accordance with IEC 651, second edition.

The measurements shall be made using the frequency weighting A, and the time weighting F.

When using a system that includes a periodic monitoring of the A-weighted sound level, a reading should be made at a time interval not greater than 30 ms.

1.1.1. *Calibration*

At the beginning and at the end of every measurement session the entire measurement system shall be checked by means of a sound calibrator that fulfils the requirements for sound calibrators of at least precision Class 1 according to IEC 942:1988. Without any further adjustment the difference between the readings of two consecutive checks shall be less than or equal to 0,5 dB. If this value is exceeded the results of the measurements obtained after the previous satisfactory check shall be discarded.

1.1.2. *Compliance with requirements*

The compliance of the sound calibration device with the requirements of IEC 942:1988 shall be verified once a year and the compliance of the instrumentation system with the requirements of IEC 651, second edition shall be verified at least every two years, by a laboratory which is authorised to perform calibrations traceable to the appropriate standards.

1.2. **Speed measurements**

The rotational speed of the engine and the vehicle speed shall be measured with instruments with an accuracy of ± 2 % or better.

1.3. **Meteorological instrumentation**

The meteorological instrumentation used to monitor the environmental conditions shall include the following:

(i) A temperature measuring device which shall be accurate within ± 1 °C;

(ii) a wind speed measuring device which shall be accurate within ± 1,0 m/s.

2. CONDITIONS OF MEASUREMENT

2.1. **Site**

2.1.1. The test site must consist of a central acceleration section surrounded by a substantially flat test area.

The acceleration section must be level; the track surface must be dry and such that rolling noise remains low.

The test track must be such that the conditions of a free sound field between the sound source and the microphone are attained to within 1 dB. This condition shall be deemed to be met if there are no large sound-reflecting objects such as fences, rocks, bridges or buildings within 50 m of the centre of the acceleration section. The surface of the site must be in accordance with the provisions given in Annex 8 to this Regulation and be free of powdery snow, tall grass, loose soil or cinders. There must be no obstacle which could affect the sound field within the vicinity of the microphone and the sound source. The observer carrying out the measurements must so position himself as not to affect the readings of the measuring instrument.

2.1.2. Measurements shall not be made under adverse weather conditions. It must be ensured that the results are not affected by gusts of wind.

Any sound peak which appears to be unrelated to the characteristics of the general sound level of the vehicle shall be ignored in taking the readings.

2.1.2.1. The meteorological instrumentation should be positioned adjacent to the test area at a height of 1,2 ± 0,1 m.

The measurements shall be made when the ambient air temperature is within the range from 0 °C to 40 °C.

Tests shall not be carried out if the wind speed, including gusts, at microphone height exceeds 5 m/s, during the sound measurement interval and shall be recorded during each test run.

Values representative of temperature, wind speed and direction, relative humidity, and barometric pressure shall be recorded during the sound measurement interval.

2.1.3. The A-weighted sound level of sound sources other than those of the vehicle to be tested and of wind effects must be at least 10 dB(A) below the sound level produced by the vehicle.

2.2. **Vehicle**

2.2.1. Measurements shall be made on unladen vehicles and, except in the case of non-separable vehicles, without trailer or semi-trailer.

2.2.2. The tyres used for the test are selected by the vehicle manufacturer and shall comply with commercial practice and be available on the market; they shall correspond to one of the tyre sizes designated for the vehicle by the vehicle manufacturer and meet the minimum tread depth of 1,6 mm in the main grooves of the tread surface.

The tyres must be inflated to the pressure(s) appropriate to the test mass of the vehicle.

2.2.3. Before the measurements are started, the vehicle shall be brought to its normal operating conditions as regards:

2.2.3.1. temperatures

2.2.3.2. tuning

2.2.3.3. fuel

2.2.3.4. sparking plugs, carburettor(s), etc., (as appropriate).

2.2.4. If the vehicle is fitted with more than two-wheel drive, it shall be tested in the drive which is intended for normal road use.

2.2.5. If the vehicle is fitted with fan(s) having an automatic actuating mechanism, this system must not be interfered with during the measurements.

2.2.6. If the vehicle is equipped with an exhaust system containing fibrous materials, the exhaust system is to be conditioned before the test according to Annex 5.

3. METHODS OF TESTING

3.1. **Measurement of noise of vehicles in motion**

3.1.1. *General conditions of test (see Appendix, figure 1)*

3.1.1.1. At least two measurements shall be made on each side of the vehicle. Preliminary measurements may be made for adjustment purposes, but shall be disregarded.

3.1.1.2. The microphone must be located at a distance of 7,5 ± 0,2 m from the reference line CC' (Figure 1) of the track and 1,2 ± 0,1 m above the ground. Its axis of maximum sensitivity must be horizontal and perpendicular to the path of the vehicle (line CC').

3.1.1.3. Two lines, AA' and BB', parallel to line PP' and situated respectively 10 m forward and 10 m rearward of that line shall be marked out on the test runway.

The vehicle shall be driven in a straight line over the acceleration section in such a way that the longitudinal median plane of the vehicle is as close as possible to the line CC' and approach line AA' at a steady speed as specified below. When the front of the vehicle reaches the line AA', the throttle shall be fully opened as rapidly as practicable and held in the fully-opened position until the rear of the vehicle crosses line BB'; the throttle shall then be closed again as rapidly as possible.

3.1.1.4. In the case of articulated vehicles consisting of two non-separable units regarded as a single vehicle, the semi-trailer shall be disregarded in determining when line BB' is crossed.

3.1.1.5. The maximum sound level expressed in A-weighted decibels (dB(A)) shall be measured as the vehicle is driven between lines AA' and BB'. Such value shall constitute the result of the measurement.

3.1.2. *Determination of the approach speed*

3.1.2.1. Symbols used

The letter symbols used in this paragraph have the following meaning:

S: engine rotation speed as indicated under item 5.4 of Annex 1.

N_A: uniform engine rotational speed at the approach of line AA'.

V_A: uniform vehicle speed at the approach of line AA'.

V_{max}: maximum speed declared by the vehicle manufacturer.

3.1.2.2. Vehicle with no gearbox

For vehicles with no gearbox or with no transmission control, the uniform speed at the approach of line AA' will be such that:

either V_A = 50 km/h;

or V_A corresponding to N_A = 3/4 S and $V_A \leq$ 50 km/h

in the case of vehicles of category M_1 and in the case of vehicles of categories other than M_1, having an engine power not greater than 225 kW (ECE);

or V_A corresponding to N_A = 1/2 S and $V_A \leq$ 50 km/h

in the case of vehicles not belonging to category M_1 having an engine power greater than 225 kW (ECE);

or, in the case of vehicles powered by an electric motor

$$V_A = \frac{3}{4} V_{max} \text{ or } V_A = 50 \text{ km/h},$$

whichever is the lower.

3.1.2.3. Vehicle with a manually-operated gearbox

3.1.2.3.1. Approach speed

The vehicle shall approach the line AA' at a steady speed with a tolerance ± 1 km/h; except where the controlling factor is engine speed the tolerance shall be the larger of ± 2 % or ± 50 min^{-1}, such that:

either V_A = 50 km/h;

or V_A corresponding to N_A = 3/4 S and $V_A \leq$ 50 km/h

in the case of vehicles of category M_1 and in the case of vehicles of categories other than M_1, having an engine power not greater than 225 kW (ECE);

or V_A corresponding to N_A = 1/2 S and $V_A \leq$ 50 km/h

in the case of vehicles not belonging to category M_1 having an engine power greater than 225 kW (ECE);

or, in the case of vehicles powered by an electric motor

$$V_A = \frac{3}{4} V_{max} \text{ or } V_A = 50 \text{ km/h},$$

whichever is the lower.

3.1.2.3.2. Choice of the gear ratio

3.1.2.3.2.1. Vehicles of categories M_1 and N_1 [1] fitted with a gearbox having four or less forward gears shall be tested in second gear.

3.1.2.3.2.2. Vehicles of categories M_1 and N_1 [1] fitted with a gearbox having more than four forward gears shall be tested successively in second and third gear. The average value of the sound levels recorded for these two conditions shall be calculated.

However, vehicles of category M_1 having more than four forward gears and equipped with an engine developing a maximum power greater than 140 kW (ECE) and a permissible maximum-power/maximum-mass ratio greater than 75 kW (ECE)/t shall be tested only in third gear, provided that the speed at which the rear of the vehicle passes the line BB' in third gear is greater than 61 km/h.

If during the test in second gear, the engine speed exceeds the engine speed, S, at which the engine develops its rated maximum power, the test must be repeated with an approach speed and/or approach engine speed reduced by steps of 5 % S, until the engine speed attained no longer exceeds S.

If the engine speed S is still attained with an approach speed corresponding to the idle speed, then the test will be performed only in third gear and the relevant results have to be evaluated.

3.1.2.3.2.3. Vehicles of categories other than M_1 and N_1, in which the total number of forward gear ratios is x (including those obtained by way of an auxiliary transmission or a multi-gear axle) will be tested sequentially, using the ratio equal to or higher than x/n [2] [3].

Initial testing will be carried out using the ratio which is gear (x/n) or the next higher gear ratio if (x/n) is not an integer. The testing shall continue from the gear (x/n) to the next higher gear.

Shifting up gear ratios from (x/n) shall be terminating when in the gear X in which the rated engine speed is reached just before the rear of the vehicle has passed the line BB'.

[1] As defined in Annex 4 to this Regulation.
[2] Where: n = 2 for vehicles having an engine power not greater than 225 kW (ECE): n = 3 for vehicles having an engine power greater than 225 kW (ECE).
[3] If x/n does not correspond to a whole number, the nearest higher ratio must be used.

Sample calculation for testing: There are 16 forward ratios for drive train having a transmission with eight gears and an auxiliary transmission with two gears. If the engine has 230 kW then (x/n) = (8 × 2)/3 = 16/3 = 5 1/3. The initial test gear ratio is sixth (includes the gears from both the main transmission and auxiliary which is sixth out of the 16 total gear ratios), with the next gear ratio is seventh up to ratio X.

In the case of vehicles having different overall gear ratios the representative of the vehicle type by the test vehicle is determined as follows:

if the highest sound level is obtained between the ratio x/n and ratio X the vehicle shall be deemed representative of its type;

if the highest sound level is obtained at ratio x/n the vehicle selected shall be deemed representative of its type only for those vehicles which have a lower overall gear ratio at x/n;

if the highest sound level is obtained at ratio X the vehicle selected shall be deemed representative of its type only for those vehicles which have a higher overall gear ratio than the gear ratio X.

However the vehicle is deemed representative of its type also, if at the applicant's request the tests are extended over more ratios than foreseen, and the highest sound level is obtained between the extreme ratios tested.

3.1.2.4. Automatic transmission [1]

3.1.2.4.1. Vehicles without a manual selector

3.1.2.4.1.1. Approach speed

The vehicle shall approach the line AA' at various uniform speeds of 30, 40, 50 km/h or at 3/4 of the maximum on-road speed if this value is lower.

If the vehicle is equipped with an automatic transmission which cannot be tested with the procedure outlined in the subsequent sections, it shall be tested at different approach speeds, namely 30 km/h, 40 km/h, and 50 km/h, or at three quarters of maximum vehicle speed as specified by the manufacturer if this value is lower. The condition giving the highest noise level shall be retained.

3.1.2.4.2. Vehicles equipped with a manual selector with X positions

3.1.2.4.2.1. Approach speed

The vehicle shall approach the line AA' at a steady speed corresponding to the lower of the following velocities with a tolerance ± 1 km/h; except where the controlling factor is engine speed the tolerance shall be the larger of ± 2 % or ± 50 rpm, such that:

either V_A = 50 km/h;

or V_A corresponding to N_A = 3/4 S and $V_A \leq$ 50 km/h

in the case of vehicles of category M_1 and in the case of vehicles of categories other than M_1, having an engine power not greater than 225 kW (ECE);

or V_A corresponding to N_A = 1/2 S and $V_A \leq$ 50 km/h

in the case of vehicles not belonging to category M_1 having an engine power greater than 225 kW (ECE);

or, in the case of vehicles powered by an electric motor

$$V_A = \frac{3}{4} V_{max} \text{ or } V_A = 50 \text{ km/h},$$

whichever is the lower.

[1] All vehicles equipped with automatic transmission.

However, if during the test, in the case of vehicles having more than two separate gears, there is an automatic downshift to first gear, this downshift may be avoided, at the manufacturer's choice, according to paragraph 3.1.2.4.2.4.

3.1.2.4.2.2. Position of the manual selector

The test shall be conducted with the selector in the position recommended by the manufacturer for 'normal' driving. External downshifting (for example kickdown) shall be excluded.

3.1.2.4.2.3. Auxiliary gears

If the vehicle is fitted with an auxiliary manual transmission or a multi-gear axle, the position used for normal urban driving shall be used. In all cases, the special selector's positions for slow movements, parking, or braking shall be excluded.

3.1.2.4.2.4. Prevention of downshift

Some vehicles equipped with an automatic transmission (two or more discrete ratios) may downshift to a gear ratio not normally used in urban driving, as defined by the manufacturer. A gear ratio not used for urban driving includes a gear ratio intended for slow movement, parking or braking. In these cases the operator may select any of the following modifications:

(a) increase the vehicle speed v to a maximum of 60 km/h in order to avoid such a change down;

(b) maintain the vehicle speed v at 50 km/h and limit the fuel supply to the engine to 95 % of the supply necessary for full load; this condition is considered to be satisfied;

(i) in the case of a spark-ignition engine, when the angle of the throttle opening is 90 % of the full angle;

(ii) in the case of a compression-ignition engine, when the fuel supply to the injection pump is limited to 90 % of its maximum supply;

(c) establish and use an electronic control that will prevent a downshift to gears lower than those used in normal urban driving as defined by the manufacturer.

3.1.3. *Interpretation of results*

The measurement of noise emitted by the vehicle in motion shall be considered valid if the difference between the two consecutive measurements on the same side of the vehicle is not more than 2 dB(A) [1].

The figure recorded shall be that corresponding to the highest sound level. Should that figure exceed by more than 1 dB(A) the maximum sound level authorised for the category of vehicle tested, a second series of two measurements at the corresponding microphone position shall be made. Three out of the four results so obtained in this second position must fall within the prescribed limits.

To allow for lack of precision in the measuring instrument the figures read from it during measurement shall each be reduced by 1 dB(a).

3.2. **Measurement of noise emitted by stationary vehicles**

3.2.1. *Sound level in the vicinity of vehicles*

In order to facilitate subsequent checks on vehicles in use, the sound level must be measured close to the exhaust system outlet in accordance with the following requirements and the measurement results entered in the test report drawn up for the purpose of issuing the certificate referred to in Annex 1.

[1] The spread of results between runs may be reduced if there is a one minute wait between runs, at idle in neutral, which stabilises the vehicle operating temperature.

3.2.2. *Acoustic measurements*

A precision sound level meter as defined in paragraph 1.1 of this Annex must be used for the measurements.

3.2.3. *Test site — local conditions (Figure 2)*

3.2.3.1. Measurements should be made on a stationary vehicle in an area which corresponds to that for measurements of vehicles in motion and therefore corresponds to the provisions given in Annex 8 to this Regulation.

3.2.3.2. During the test nobody shall be in the measurement area, except the observer and the driver whose presence must have no influence on the meter reading.

3.2.4. *Disturbance noise and wind interference*

Readings on the measuring instruments produced by ambient noise and wind must be at least 10 dB(A) below the sound level to be measured. A suitable windscreen may be fitted to the microphone provided that account is taken of its effect on the sensitivity of the microphone.

3.2.5. *Measuring method*

3.2.5.1. Nature and number of measurements

The maximum sound level expressed in A-weighted decibels (dB(A)) must be measured during the operating period referred to in paragraph 3.2.5.3.2.1.

At least three measurements must be taken at each measuring point.

3.2.5.2. Positioning and preparation of the vehicle

The vehicle shall be located in the centre part of the test area with the gear level in neutral position and the clutch engaged. If the design of the vehicle does not allow this, the vehicle shall be tested in conformity with the manufacturer's prescriptions for stationary engine testing. Before each series of measurements, the engine must be brought to its normal operating condition, as specified by the manufacturer.

If the vehicle is fitted with fan(s) having an automatic actuating mechanism, this system shall not be interfered with during the sound level measurements.

3.2.5.3. Measuring of noise in proximity to the exhaust (see Appendix, Figure 2)

3.2.5.3.1. Positions of the microphone

3.2.5.3.1.1. The height of the microphone above the ground should be equal to that of the outlet pipe of the exhaust gases, but in any event shall be limited to a minimum value of 0,2 m.

3.2.5.3.1.2. The microphone must be pointed towards the orifice of the gas flow and located at a distance of 0,5 m from the latter.

3.2.5.3.1.3. Its axis of maximum sensitivity must be parallel to the ground and must make an angle of 45° ± 10° with the vertical plane containing the direction of the gas flow. The instructions of the manufacturer of the sound level meter with regard to this axis must be respected. In relation to this plane, the microphone shall be placed in such a way as to obtain the maximum distance from the longitudinal median plane of the vehicle; in case of doubt, the position which gives the maximum distance from the contour of the vehicle shall be selected.

3.2.5.3.1.4. In the case of an exhaust provided with two or more outlets spaced less than 0,3 m apart and which are connected to the same silencer, only one measurement is made; the microphone position is related to the outlet nearest to one extreme edge of the vehicle or, when such outlet does not exist, to the outlet which is the highest above the ground.

3.2.5.3.1.5. For vehicles with a vertical exhaust (e.g. commercial vehicles) the microphone should be placed at the height of the exhaust outlet. Its axis should be vertical and oriented upwards. It should be placed at a distance of 0,5 m from the side of the vehicle nearest to the exhaust.

3.2.5.3.1.6. For vehicles having an exhaust provided with outlets spaced more than 0,3 m apart, one measurement is made for each outlet as if it were the only one, and the highest level is noted.

3.2.5.3.2. Operating conditions of the engine

3.2.5.3.2.1. The engine is operated at a constant speed having the following value: 3/4 S for both controlled ignition engines and for diesel engines.

3.2.5.3.2.2. When constant engine speed is reached, the throttle shall be returned swiftly to the idle position. The sound level shall be measured during a period of operation consisting of a brief maintenance of constant engine speed and throughout the entire deceleration period, the maximum sound level meter reading being taken as the test value.

3.2.6. *Results*

3.2.6.1. Readings, rounded off to the nearest decibel, shall be taken from the measuring instrument.

Only those values obtained from three consecutive measurements which do not differ by more than 2 dB(A) respectively will be taken into consideration.

3.2.6.2. The highest of these three values shall constitute the test result.

Appendix to Annex 3

Measuring positions for vehicles in motion

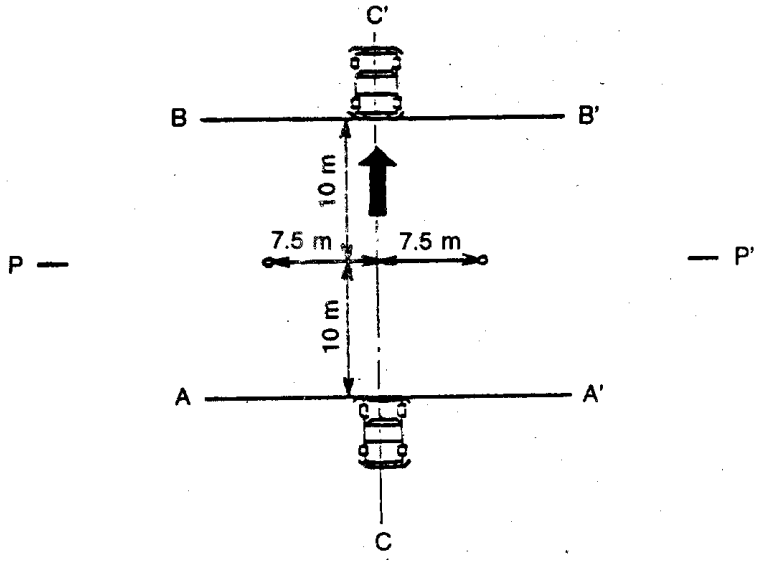


Fig.1

Measuring positions for stationary vehicles
(examples)

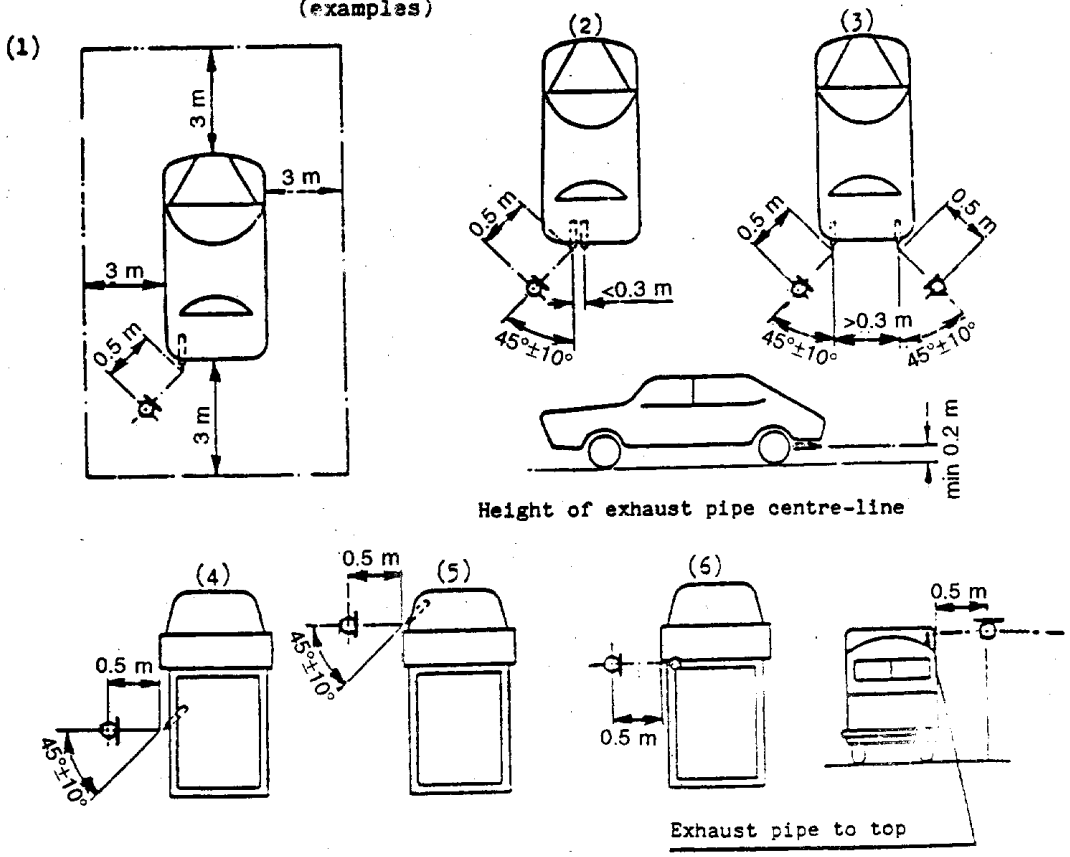


Fig.2

ANNEX 4

CLASSIFICATION OF VEHICLES [1]

1. CATEGORY L

(Not applicable for this Regulation)

2. CATEGORY M — POWER-DRIVEN VEHICLES HAVING AT LEAST FOUR WHEELS AND USED FOR THE CARRIAGE OF PASSENGERS

2.1. Category M_1: Vehicles used for the carriage of passengers and comprising not more than eight seats in addition to the driver's seat.

2.2. Category M_2: Vehicles used for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass not exceeding five tonnes.

2.3. Category M_3: Vehicles used for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass exceeding five tonnes.

2.4. Vehicles of categories M_2 and M_3 belong to one of the three following classes:

2.4.1. Class I 'city-bus': a vehicle of this class has seats, and spaces for standing passengers.

2.4.2. Class II 'interurban bus or coach': a vehicle of this class may have provision for standing passengers, but only in the gangway.

2.4.3. Class III 'touring coach': a vehicle of this class has no provisions to carry standing passengers.

2.5. Remarks

2.5.1. 'Articulated bus or coach' is a vehicle which consists of two or more rigid sections which articulate relative to one another; the passenger compartments of each section intercommunicate so that passengers can move freely between them; the rigid sections are permanently connected so that they can only be separated by an operation involving facilities which are normally only found in a workshop.

2.5.2. Articulated buses or coaches comprising two or more non-separable but articulated units shall be considered as single vehicles.

2.5.3. In the case of a towing vehicle designed to be coupled to a semi-trailer (tractor for semi-trailer), the mass to be considered for classifying the vehicle is the mass of the tractor vehicle in running trim, increased by the mass corresponding to the maximum static vertical load transferred to the tractor vehicle by the semi-trailer and, where applicable, by the maximum mass of the tractor vehicle's own load.

3. CATEGORY N — POWER-DRIVEN VEHICLES HAVING AT LEAST FOUR WHEELS AND USED FOR THE CARRIAGE OF GOODS

3.1. Category N_1: Vehicles used for the carriage of goods and having a maximum mass not exceeding 3,5 tonnes.

3.2. Category N_2: Vehicles used for the carriage of goods and having a maximum mass exceeding 3,5 tonnes but not exceeding 12 tonnes.

3.3. Category N_3: Vehicles used for the carriage of goods and having a maximum mass exceeding 12 tonnes.

3.4. Remarks

3.4.1. In the case of a towing vehicle designed to be coupled to a semi-trailer (tractor for semi-trailer), the mass to be considered for classifying the vehicle is the mass of the tractor vehicle in running trim, increased by the mass corresponding to the maximum static vertical load transferred to the tractor vehicle by the semi-trailer and, where applicable, by the maximum mass of the tractor vehicle's own load.

3.4.2. The equipment and installations carried on certain special-purpose vehicles (crane vehicles, workshop vehicles, publicity vehicles, etc.) are regarded as being equivalent to goods.

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[1] In conformity with the Consolidated Resolution on the Construction of Vehicles (R.E.3) (TRANS/SC1/WP29/78/Amend.3, Annex 7).

ANNEX 5

EXHAUST SYSTEMS CONTAINING FIBROUS MATERIALS

1. Fibrous materials shall not be used in the construction of silencers unless suitable measures are undertaken at the design or production stages to ensure that the efficiency required to comply with the limits imposed in paragraph 6.2.2 of this Regulation is achieved on the road. Such a silencer shall be considered to be efficient on the road if the exhaust gases are not in contact with the fibrous materials or if the silencer of the prototype vehicle tested in accordance with the requirements of paragraphs 3.1 and 3.2 of this Regulation has been put into a normal state for road use before the sound level measurements are taken. This can be achieved by using one of the three tests described in paragraphs 1.1, 1.2 and 1.3 or by removing the fibrous materials from the silencer.

1.1. **Continuous road operation for 10 000 km**

1.1.1. About half this operation consists of town driving and the other half of long distance runs at high speed; continuous road operation can be replaced by a corresponding test-track programme.

1.1.2. The two speed régimes should be alternated on several occasions.

1.1.3. The complete test programme must include a minimum of 10 breaks of at least three hours duration in order to reproduce the effects of cooling and any condensation which may occur.

1.2. **Conditioning on a test bench**

1.2.1. Using standard parts and observing the vehicle manufacturer's instructions, the exhaust system or components thereof must be fitted to the vehicle referred to in paragraph 3.3 of this Regulation or the engine referred to in paragraph 3.4 of this Regulation. In the former case the vehicle must be mounted on a roller dynamometer. In the second case, the engine must be coupled to a dynamometer.

1.2.2. The test must be conducted in six six-hour periods with a break of at least 12 hours between each period in order to reproduce the effects of cooling any condensation which may occur.

1.2.3. During each six-hour period, the engine shall be run, under the following conditions in turn:

1. Five minutes at idling speed;
2. One-hour sequence under 1/4 load at 3/4 of rated maximum speed (S);
3. One-hour sequence under 1/2 load at 3/4 of rated maximum speed (S);
4. 10-minute sequence under full load at 3/4 of rated maximum speed (S);
5. 15-minute sequence under 1/2 load at rated maximum speed (S);
6. 30-minute sequence under 1/4 load at rated maximum speed (S).

Total duration of the six sequences: three hours.

Each period must comprise two sets of the six above mentioned sequences.

1.2.4. During the test, the silencer must not be cooled by a forced draught simulating normal airflow around the vehicle. Nevertheless, at the request of the manufacturer, the silencer may be cooled in order not to exceed the temperature recorded at its inlet when the vehicle is running at maximum speed.

1.3. **Conditioning by pulsation**

1.3.1. The exhaust system or components thereof must be fitted to the vehicle referred to in paragraph 3.3 of this Regulation or the engine referred to in paragraph 3.4 of this Regulation. In the former case the vehicle must be mounted on a roller dynamometer.

In the second case, the engine must be mounted on a dynamometer. The test apparatus, a detailed diagram of which is shown in Figure 3 of the Appendix to this Annex must be fitted at the outlet of the exhaust system. Any other apparatus providing equivalent results is acceptable.

1.3.2. The test apparatus must be adjusted in a such a way that the exhaust-gas flow is alternatively interrupted and re-established by the quick-action valve for 2 500 cycles.

1.3.3. The valve must open when the exhaust-gas back pressure, measured at least 100 mm downstream of the intake flange, reaches a value of between 0,35 and 0,40 bar. It must close when this pressure does not differ by more than 10 % from its stabilised value with the valve open.

1.3.4. The time-delay switch shall be set for the duration of gas exhaust resulting from the provisions laid down in paragraph 1.3.3.

1.3.5. Engine speed must be 75 % of the speed (S) at which the engine develops maximum power.

1.3.6. The power indicated by the dynamometer must be 50 % of the full-throttle power measured at 75 % of engine speed (S).

1.3.7. Any drainholes must be closed off during the test.

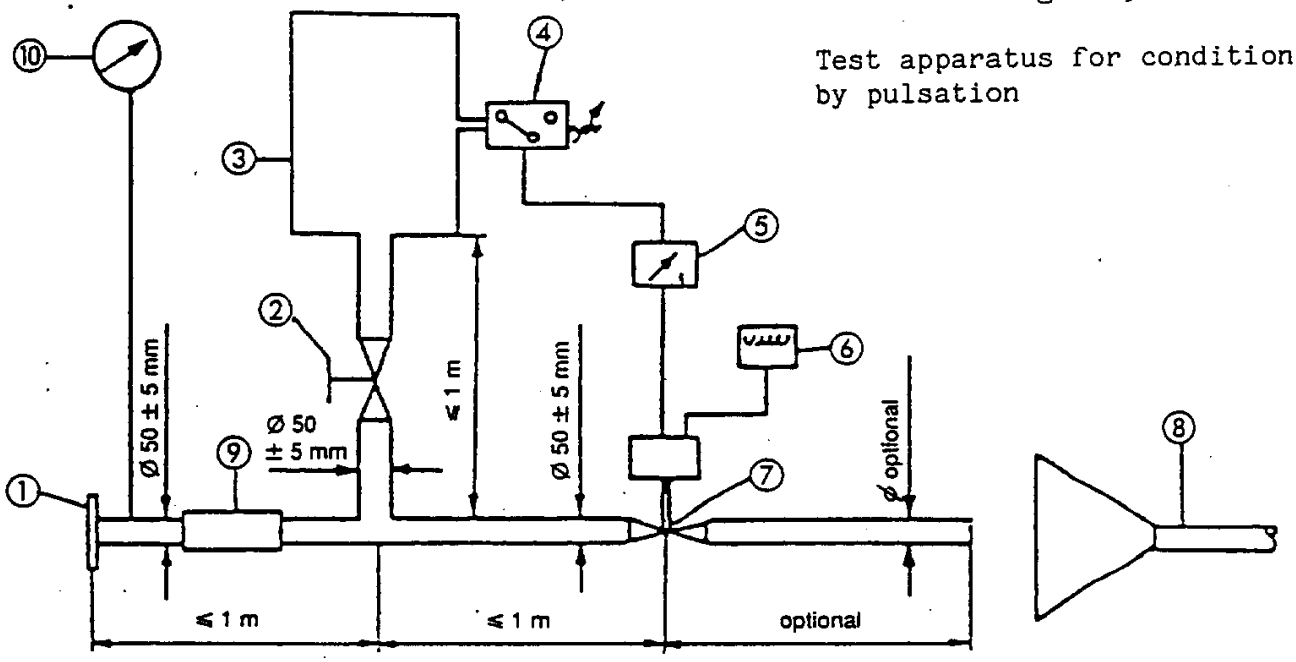
1.3.8. The entire test must be completed within 48 hours.

If necessary, one cooling period will be observed after each hour.

Appendix to Annex 5

Figure 3

Test apparatus for conditioning by pulsation



1. Inlet flange or sleeve for connection to the rear of the test exhaust system.
2. Hand-operated regulating valve.
3. Compensating reservoir with a maximum capacity of 40 l and a filling time of not less than one second.
4. Pressure switch with an operating range of 0,05 to 2,5 bar.
5. Time delay switch.
6. Pulse counter.
7. Quick-acting valve, such as exhaust brake valve 60 mm in diameter, operated by a pneumatic cylinder with an output of 120 N at 4 bar. The response time, both when opening and closing, must not exceed 0,5 second.
8. Exhaust gas evacuation.
9. Flexible pipe.
10. Pressure gauge.

ANNEX 6

COMPRESSED AIR NOISE

1. METHOD OF MEASUREMENT

The measurement is performed at microphone positions 2 and 6 according to Figure 1, with the vehicle stationary. The highest A-weighted noise level is registered during venting the pressure regulator and during ventilating after the use of both the service and parking brakes.

The noise during venting the pressure regulator is measured with the engine at idling speed. The ventilating noise is registered while operating the service and parking brakes; before each measurement, the air-compressor unit has to be brought up to the highest permissible operating pressure, and then the engine switched off.

2. EVALUATION OF THE RESULTS

For all microphone positions two measurements are taken. In order to compensate for inaccuracies of the measuring equipment, the metre reading is reduced by 1 dB(A), and the reduced value is taken as the result of measurement. The results are taken as valid if the difference between the measurements at one microphone position does not exceed 2 dB(A). The highest value measured is taken as the result. If this value exceeds the noise limit by 1 dB(A), two additional measurements are to be taken at the corresponding microphone position. In this case, three out of the four results of measurement obtained at this position have to comply with the noise limit.

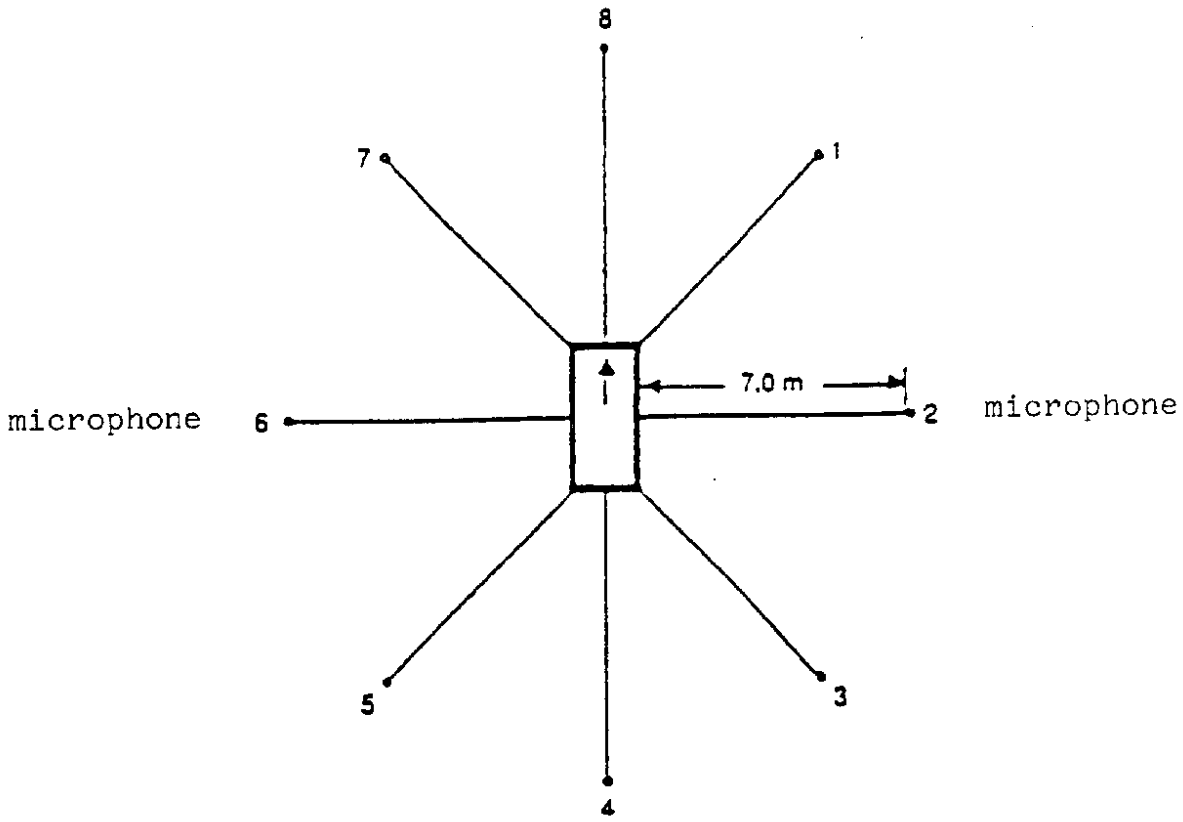
3. LIMITING VALUE

The sound level shall not exceed the limit of 72 dB(A).

Appendix to Annex 6

Figure 1

Microphone positions for measurement of compressed air noise



The measurement is performed at the stationary vehicle according to Figure 1, using two microphone positions at a distance of 7 m from the contour of the vehicles, and at 1,2 m above ground.

ANNEX 7

CHECKS ON CONFORMITY OF PRODUCTION

1. GENERAL

These requirements are consistent with the test to be held to check conformity of production according to paragraphs 8.3.5 and 8.4.3 of this Regulation.

2. TESTING PROCEDURE

The test site and measuring instruments shall be those as described in Annex 3.

2.1. The vehicle(s) under test shall be subjected to the test for measurement of noise of vehicle in motion as described in paragraph 3.1 of Annex 3.

2.2. **Compressed air noise**

Vehicles having maximum mass exceeding 2 800 kg and equipped with compressed air systems must be subjected to an additional test for measurement of the compressed air noise as described in paragraph 1 of Annex 6.

3. SAMPLING

One vehicle has to be chosen. If after the test of paragraph 4.1 the vehicle is not considered to conform to the requirements of this Regulation, two more vehicles have to be tested.

4. EVALUATION OF THE RESULTS

4.1. If the sound level of the vehicle tested pursuant to paragraphs 1 and 2 does not exceed by more than 1 dB(A) the limit value prescribed in paragraph 6.2.2 of this Regulation, for measurement according to paragraph 2.1, and in paragraph 3 of Annex 6 to this Regulation, for measurement according to paragraph 2.2, the vehicle type shall be considered to conform to the requirements of this Regulation.

4.2. If the vehicle tested according to paragraph 4.1 does not satisfy the requirements laid down in that paragraph, two more vehicles of the same type have to be tested pursuant to paragraphs 1 and 2.

4.3. If the sound level of the second and/or third vehicle of paragraph 4.2 exceeds by more than 1 dB(A) the limit values prescribed in paragraph 6.2.2 of this Regulation, the vehicle type shall be considered not to conform to the requirements of this Regulation and the manufacturer shall take the necessary measures to re-establish the conformity.

ANNEX 8

SPECIFICATIONS FOR THE TEST SITE

1. INTRODUCTION

This Annex describes the specifications relating to the physical characteristics and the laying of the test track. These specifications based on a special standard [1] describe the required physical characteristics as well as the test methods for these characteristics.

2. REQUIRED CHARACTERISTICS OF THE SURFACE

A surface is considered to conform to this standard provided that the texture and voids content or sound absorption coefficient have been measured and found to fulfil all the requirements of paragraphs 2.1 to 2.4 and provided that the design requirements (paragraph 3.2) have been met.

2.1. **Residual voids content**

The residual voids content, V_C, of the test track paving mixture shall not exceed 8 %. For the measurement procedure, see paragraph 4.1.

2.2. **Sound absorption coefficient**

If the surface fails to comply with the residual voids content requirement, the surface is acceptable only if its sound absorption coefficient, $\alpha \leq 0{,}10$. For the measurement procedure, see paragraph 4.2. The requirement of paragraphs 2.1 and 2.2 is met also if only sound absorption has been measured and found to be $\alpha \leq 0{,}10$.

Note: The most relevant characteristic is the sound absorption, although the residual voids content is more familiar among road constructors. However, sound absorption needs to be measured only if the surface fails to comply with the voids requirement. This is motivated because the latter is connected with relatively large uncertainties in terms of both measurements and relevance and some surfaces therefore erroneously may be rejected when based only on the voids measurement.

2.3. **Texture depth**

The texture depth (TD) measured according to the volumetric method (see paragraph 4.3) shall be:

$TD \geq 0{,}4$ mm

2.4. **Homogeneity of the surface**

Every practical effort shall be taken to ensure that the surface is made to be as homogeneous as possible within the test area. This includes the texture and voids content, but it should also be observed that if the rolling process results in more effective rolling at some places than others, the texture may be different and unevenness causing bumps may also occur.

2.5. **Period of testing**

In order to check whether the surface continues to conform to the texture and voids content or sound absorption requirements stipulated in this standard, periodic testing of the surface shall be done at the following intervals:

(a) For residual voids content or sound absorption:

when the surface is new;

if the surface meets the requirements when new, no further periodical testing is required. If it does not meet the requirement when it is new, it may do later because surfaces tend to become clogged and compacted with time.

[1] ISO 10844:1994.

(b) For texture depth (TD):

when the surface is new;

when the noise testing starts (*NB:* not before four weeks after laying);

then every 12 months.

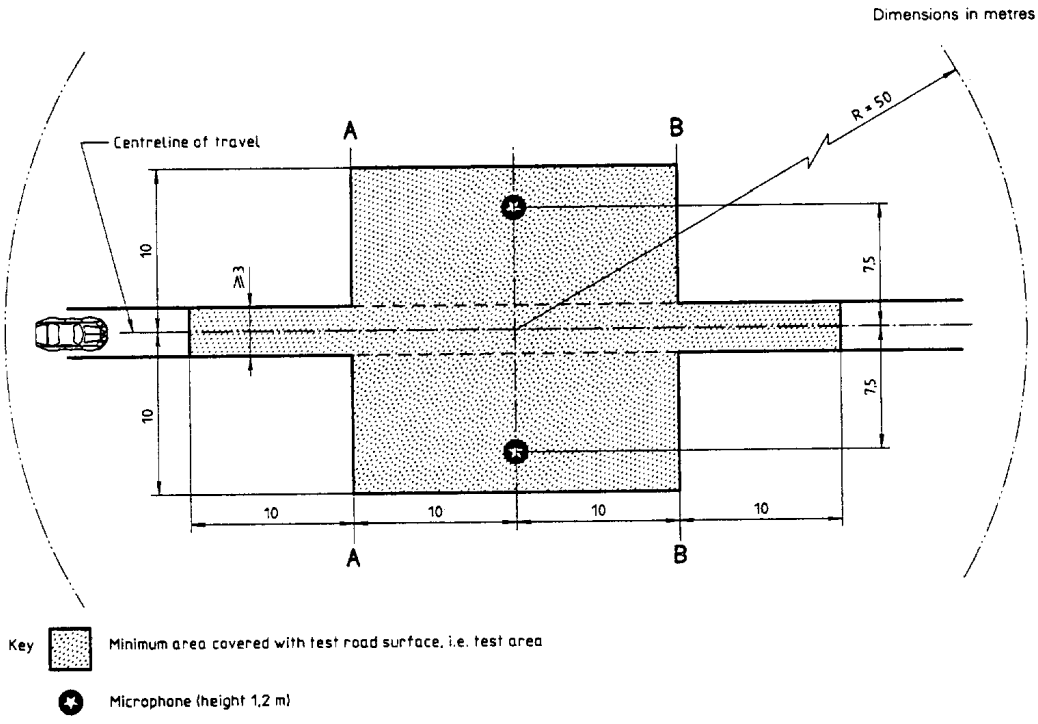
3. TEST SURFACE DESIGN

3.1. **Area**

When designing the test track layout it is important to ensure that, as a minimum requirement, the area traversed by the vehicles running through the test strip is covered with the specified test material with suitable margins for safe and practical driving. This will require that the width of the track is at least 3 m and the length of the track extends beyond lines AA and BB by at least 10 m at either end. Figure 1 shows a plan of a suitable test site and indicates the minimum area which shall be machine laid and machine compacted with the specified test surface material. According to Annex 3, paragraph 3.1.1.1, measurements have to be made on each side of the vehicle. This can be made either by measuring with two microphone locations (one on each side of the track) and driving in one direction, or measuring with a microphone only on one side of the track but driving the vehicle in two directions. If the latter method is used, then there are no surface requirements on that side of the track where there is no microphone.

Figure 1

Minimum requirement for test surface area. The shaded part is called 'Test Area'



NOTE — There shall be no large acoustically reflective objects within this radius.

3.2. **Design and preparation of the surface**

3.2.1. *Basic design requirements*

The test surface shall meet four design requirements:

3.2.1.1. It shall be a dense asphaltic concrete.

3.2.1.2. The maximum chipping size shall be 8 mm (tolerances allow from 6,3 to 10 mm).

3.2.1.3. The thickness of the wearing course shall be ≥ 30 mm.

3.2.1.4. The binder shall be a straight penetration grade bitumen without modification.

3.2.2. *Design guidelines*

As a guide to the surface constructor, an aggregate grading curve which will give desired characteristics is shown in Figure 2. In addition, Table 1 gives some guidelines in order to obtain the desired texture and durability. The grading curve fits the following formula:

P (% passing) = $100 \times (d/d_{max})^{1/2}$

where:

d = square mesh sieve size, in mm

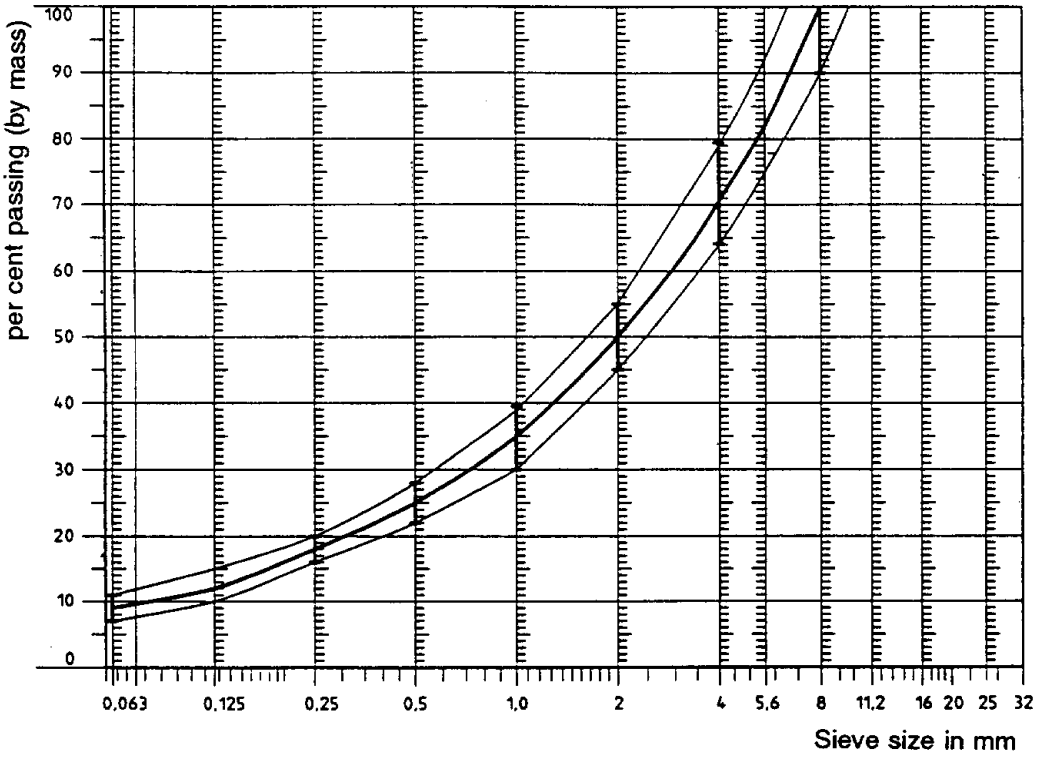
d_{max} = 8 mm for the mean curve

d_{max} = 10 mm for the lower tolerance curve

d_{max} = 6,3 mm for the upper tolerance curve

Figure 2

Grading curve of the aggregate in the asphaltic mix with tolerances



In addition to the above, the following recommendations are given:

(a) The sand fraction (0,063 mm < square mesh sieve size < 2 mm) shall include no more than 55 % natural sand and at least 45 % crushed sand;

(b) The base and sub-base shall ensure a good stability and evenness, according to best road construction practice;

(c) The chippings shall be crushed (100 % crushed faces) and of a material with a high resistance to crushing;

(d) The chippings used in the mix shall be washed;

(e) No extra chippings shall be added onto the surface;

(f) The binder hardness expressed as PEN value shall be 40-60, 60-80 or even 80-100 depending on the climatic conditions of the country. The rule is that as hard a binder as possible shall be used, provided this is consistent with common practice;

(g) The temperature of the mix before rolling shall be chosen so as to achieve by subsequent rolling the required voids content. In order to increase the probability of satisfying the specifications of paragraphs 2.1 to 2.4, the compactness shall be studied not only by an appropriate choice of mixing temperature, but also by an appropriate number of passings and by the choice of compacting vehicle.

Table 1

Design guidelines

	Target values		Tolerances
	By total mass of mix	By mass of the aggregate	
Mass of stones, square mesh sieve (SM) > 2 mm	47,6 %	50,5 %	± 5
Mass of sand 0,063 < SM < 2 mm	38,0 %	40,2 %	± 5
Mass of filler SM < 0,063 mm	8,8 %	9,3 %	± 2
Mass of binder (bitumen)	5,8 %	NA	± 0,5
Max. chipping size	8 mm		6,3-10
Binder hardness	(see paragraph 3.2.2. (f))		
Polished stone value (PSV)	> 50		
Compactness, relative to Marshall compactness	98 %		

4. TEST METHOD

4.1. **Measurement of the residual voids content**

For the purpose of this measurement, cores have to be taken from the track in at least four different positions which are equally distributed in the test area between lines AA and BB (see Figure 1). In order to avoid inhomogeneity and unevenness in the wheel tracks, cores should not be taken in wheel tracks themselves, but close to them. Two cores (minimum) should be taken close to the wheel tracks and one core (minimum) should be taken approximately midway between the wheel tracks and each microphone location.

If there is a suspicion that the condition of homogeneity is not met (see paragraph 2.4.), cores shall be taken from more locations within the test area.

The residual voids content has to be determined for each core, then the average value from all cores shall be calculated and compared with the requirement of paragraph 2.1. In addition, no single core shall have a voids value which is higher than 10 %. The test surface constructor is reminded of the problem which may arise when the test area is heated by pipes or electrical wires and cores must be taken from this area. Such installations must be carefully planned with respect to future core drilling locations. It is recommended to leave a few locations of size approximately 200 × 300 mm where there are no wires/pipes or where the latter are located deep enough in order not to be damaged by cores taken from the surface layer.

4.2. **Sound absorption coefficient**

The sound absorption coefficient (normal incidence) shall be measured by the impedance tube method using the procedure specified in ISO 10534-1: 'Acoustics — Determination of sound absorption coefficient and impedance by a tube method' ([1]).

Regarding test specimens, the same requirements shall be followed as regarding the residual voids content (see paragraph 4.1). The sound absorption shall be measured in the range between 400 Hz and 800 Hz and in the range between 800 Hz and 1 600 Hz (at least at the centre frequencies of third octave bands) and the maximum values shall be identified for both of these frequency ranges. Then these values, for all test cores, shall be averaged to constitute the final result.

4.3. **Volumetric macrotexture measurement**

For the purpose of this standard, texture depth measurements shall be made on at least 10 positions evenly spaced along the wheel tracks of the test strip and the average value taken to compare with the specified minimum texture depth. See ISO 10844:1994 for the description of the procedure.

5. STABILITY IN TIME AND MAINTENANCE

5.1. **Age influence**

In common with any other surfaces, it is expected that the tyre/road noise level measured on the test surface may increase slightly during the first 6-12 months after construction.

The surface will achieve its required characteristics not earlier than four weeks after construction. The influence of age on the noise from trucks is generally less than that from cars.

The stability over time is determined mainly by the polishing and compaction by vehicles driving on the surface. It shall be periodically checked as stated in paragraph 2.5.

5.2. **Maintenance of the surface**

Loose debris or dust which could significantly reduce the effective texture depth must be removed from the surface. In countries with winter climates, salt is sometimes used for de-icing. Salt may alter the surface temporarily or even permanently in such a way as to increase noise and is therefore not recommended.

5.3. **Repaving the test area**

If it is necessary to repave the test track, it is usually unnecessary to repave more than the test strip (of 3 m width in Figure 1) where vehicles are driving, provided the test area outside the strip met the requirement of residual voids content or sound absorption when it was measured.

6. DOCUMENTATION OF THE TEST SURFACE AND OF TESTS PERFORMED ON IT

6.1. **Documentation of the test surface**

The following data shall be given in a document describing the test surface:

6.1.1. The location of the test track.

6.1.2. Type of binder, binder hardness, type of aggregate, maximum theoretical density of the concrete (D_R), thickness of the wearing course and grading curve determined from cores from the test track.

6.1.3. Method of compaction (e.g. type of roller, roller mass, number of passes).

6.1.4. Temperature of the mix, temperature of the ambient air and wind speed during laying of the surface.

6.1.5. Date when the surface was laid and contractor.

6.1.6. All or at least the latest test result, including:

6.1.6.1. The residual voids content of each core.

([1]) To be published.

6.1.6.2. The locations in the test area from where the cores for voids measurements have been taken.

6.1.6.3. The sound absorption coefficient of each core (if measured). Specify the results both for each core and each frequency range as well as the overall average.

6.1.6.4. The locations in the test area from where the cores for absorption measurement have been taken.

6.1.6.5. Texture depth, including the number of tests and standard deviation.

6.1.6.6. The institution responsible for tests according to paragraphs 6.1.6.1 and 6.1.6.2 and the type of equipment used.

6.1.6.7. Date of the test(s) and date when the cores were taken from the test track.

6.2. **Documentation of vehicle noise tests conducted on the surface**

In the document describing the vehicle noise test(s) it shall be stated whether all the requirements of this standard were fulfilled or not. Reference shall be given to a document according to paragraph 6.1 describing the results which verify this.

ANNEX 9

VEHICLE AND TEST DATA PURSUANT TO MEASUREMENT METHOD B

Information reported in Annex 1 need not to be repeated.

1. Trade name or mark of the vehicle: .....

2. Vehicle type: .....

2.1. Maximum mass including semi-trailer (where applicable):.....

.....

3. Manufacturer's name and address: .....

4. If applicable, name and address of manufacturer's representative: .....

.....

5. Engine:

5.1. Manufacturer: .....

5.2. Type: .....

5.3. Model: .....

5.4. Rated maximum power (ECE): ..... kW at ..... min^{-1} (rpm).

5.5. Kind of engine: e.g. positive-ignition, compression ignition, etc. ([1]):

.....

5.6. Cycles: two-stroke or four-stroke (if applicable): .....

5.7. Cylinder capacity (if applicable): .....

6. Transmission: non-automatic gearbox/automatic gearbox ([2]):

6.1. Number of gears: .....

7. Equipment:

7.1. Exhaust silencer: .....

7.1.1. Manufacturer or authorised representative (if any): .....

7.1.2. Model: .....

7.1.3. Type: ..... in accordance with drawing No: .....

7.2. Intake silencer: .....

7.2.1. Manufacturer or authorised representative (if any): .....

7.2.2. Model: .....

7.2.3. Type: ..... in accordance with drawing No: .....

7.3. Elements of capsulation:

7.3.1. Elements of noise encapsulation as defined by the vehicle manufacturer:.....

7.3.2. Manufacturer or authorised representative (if any): .....

7.4. Tyres:

7.4.1. Tyre size(s) (by axle): .....

8. Measurements:

8.1. Length of the vehicle (l_{veh}): ..... mm

8.2. Point of accelerator depression: ..... m before line AA'

8.2.1. Engine speed in gear i at: AA'/PP' ([1]) ..... min^{-1} (rpm)

BB' ..... min^{-1} (rpm)

8.2.2. Engine speed in gear (i+1) at: AA'/PP' ([1]) ..... min^{-1} (rpm)

BB' ..... min^{-1} (rpm)

8.3. Type approval number of tyre(s): .....

if not available, the following information shall be provided:

8.3.1. Tyre manufacturer: .....

8.3.2. Commercial description(s) of the type of tyre (by axle), (e.g. trade name, speed index, load index):

.....

8.3.3. Tyre size (by axle): .....

8.3.4. Type approval number (if available): .....

8.4. Noise level of moving vehicle:

Test result (l urban): ..... dB(A)

Test result (l wot): ..... dB(A)

Test result (l cruise): ..... dB(A)

kp — factor: .....

8.5. Noise level of stationary vehicle:

Position and orientation of microphone (according to Figure 2 in Appendix to Annex 3)

Test result for stationary test: ..... dB(A)

8.6. Noise level of compressed air sound:

Test result for

— service brake: ..... dB(A)

— parking brake: ..... dB(A)

— during the pressure regulator actuation: ..... dB(A)

9. Vehicle submitted for approval on: .....

10. Technical service responsible for typeapproval tests: .....

.....

11. Date of test report issued by that service: .....

12. Number of test report issued by that service: .....

13. Position of approval mark on the vehicle: .....

14. Place: .....

15. Date: .....

16. Signature: .....

17. The following documents, bearing the approval number shown above, are Annexed to this document:

.....

.....

drawings and/or photographs, diagrams and plans of the engine and of the noise reduction system;

list of components, duly identified constituting the noise reduction system.

18. Reason for extension of approval:

19. Remarks: .....

(1) If a non-conventional engine is used, this should be stated.
(2) Strike out what does not apply.

ANNEX 10

METHODS AND INSTRUMENTS FOR MEASURING THE NOISE MADE BY MOTOR VEHICLES (MEASUREMENT METHOD B)

1. MEASURING INSTRUMENTS

1.1. **Acoustic measurements**

The apparatus used for measuring the noise level must be a precision sound-level meter or equivalent measurement system meeting the requirements of class 1 instruments (inclusive of the recommended wind-screen, if used). These requirements are described in 'IEC 61672-1:2002: Precision sound-level meters', second edition, of the International Electrotechnical Commission (IEC).

Measurements shall be carried out using the 'fast' response of the acoustic measurement instrument and the 'A' weighting curve also described in 'IEC 61672-1:2002'. When using a system that includes a periodic monitoring of the A-weighted sound pressure level, a reading should be made at a time interval not greater than 30 ms.

The instruments shall be maintained and calibrated in accordance to the instructions of the instrument manufacturer.

1.2. **Compliance with requirements**

Compliance of the acoustic measurement instrumentation shall be verified by the existence of a valid certificate of compliance. These certificates shall be deemed to be valid if certification of compliance with the standards was conducted within the previous 12 months period for the sound calibration device and within the previous 24 months period for the instrumentation system. All compliance testing must be conducted by a laboratory, which is authorised to perform calibrations traceable to the appropriate standards.

1.3. **Calibration of the entire acoustic measurement system for measurement session**

At the beginning and at the end of every measurement session, the entire acoustic measurement system shall be checked by means of a sound calibrator that fulfils the requirements for sound calibrators of precision class 1 according to IEC 60942:2003. Without any further adjustment the difference between the readings shall be less than or equal to 0,5 dB. If this value is exceeded, the results of the measurements obtained after the previous satisfactory check shall be discarded.

1.4. **Instrumentation for speed measurements**

The engine speed shall be measured with instrumentation having an accuracy of ± 2 % or better at the engine speeds required for the measurements being performed.

The road speed of the vehicle shall be measured with instrumentation having an accuracy of at least ± 0,5 km/h, when using continuous measurement devices.

If testing uses independent measurements of speed, this instrumentation must meet specification limits of at least ± 0,2 km/h.

1.5. **Meteorological instrumentation**

The meteorological instrumentation used to monitor the environmental conditions during the test shall include the following devices, which meet at least the given accuracy:

— temperature measuring device, ± 1 °C;

— wind speed measuring device, ± 1,0 m/s;

— barometric pressure measuring device, ± 5 hPa;

— a relative humidity measuring device, ± 5 %.

2. CONDITIONS OF MEASUREMENT

2.1. **Test Site 1** [1] **and ambient conditions**

The test site shall be substantially level. The surface of the test track shall be dry. The test site shall be such that when a small omni-directional noise source is placed on its surface at the central point (intersection of the microphone line PP' and the centre line of the vehicle lane CC'), deviations from hemispherical acoustic divergence shall not exceed ± 1 dB.

This condition is deemed to be satisfied if the following requirements are met:

— within a radius of 50 m from the centre of the track the space is free of large reflecting objects such as fences, rocks, bridges or buildings,

— the test track and the surface of the site are dry and free from absorbing materials such as powdery snow, or loose debris,

— in the vicinity of the microphone, there are no obstacles that could influence the acoustical field and no person is positioned between the microphone and the noise source. The meter observer is positioned so as not to influence the meter reading.

Measurements shall not be made under adverse weather conditions. It must be ensured that the results are not affected by gusts of wind.

The meteorological instrumentation should be positioned adjacent to the test area at a height of 1,2 m ± 0,02 m. The measurements shall be made when the ambient air temperature is within the range from 5 °C to 40 °C.

The tests shall not be carried out if the wind speed, including gusts, at microphone height exceeds 5 m/s, during the noise measurement interval.

A value representative of temperature, wind speed and direction, relative humidity, and barometric pressure shall be recorded during the noise measurement interval.

Any noise peak which appears to be unrelated to the characteristics of the general noise level of the vehicle shall be ignored in taking the readings.

The background noise shall be measured for duration of 10 seconds immediately before and after a series of vehicle tests. The measurements shall be made with the same microphones and microphone locations used during the test. The A-weighted maximum noise pressure level shall be reported.

The background noise (including any wind noise) shall be at least 10 dB below the A-weighted noise pressure level produced by the vehicle under test. If the difference between the ambient noise and the measured noise is between 10 and 15 dB(A), in order to calculate the test results the appropriate correction must be substracted from the readings on the noise-level meter, as in the following table:

Difference between ambient noise and noise to be measured dB(A)	10	11	12	13	14	15
Correction dB(A)	0,5	0,4	0,3	0,2	0,1	0,0

[1] In conformity with Annex 8 to this Regulation.

2.2. **Vehicle**

2.2.1. The vehicle tested shall be selected in a way so that that all vehicles of the same type which are put on the market fulfil the requirements of this Regulation. Measurements shall be made without any trailer, except in the case of non-separable vehicles. Measurements shall be made on vehicles at the test mass m_t specified according to the following table:

Vehicle category	Vehicle test mass
M_1	$m_t = m_{ro}$
N_1	$m_t = m_{ro}$
N_2, N_3	m_t = 50 kg per kW rated engine power Extra loading to reach the test mass of the vehicle shall be placed above the driven rear axle(s). The extra loading is limited to 75 % of the maximum mass allowed for the rear axle. The test mass must be achieved with a tolerance of ± 5 %. If the centre of gravity of the extra loading cannot be aligned with the centre of the rear axle, the test mass of the vehicle shall not exceed the sum of the front axle and the rear axle load in unladen condition plus the extra loading. The test mass for vehicles with more than two axles shall be the same as for a two-axle vehicle.
M_2, M_3	$m_t = m_{ro}$ – mass of the crew member (if applicable)

2.2.2. The tyres to be used for the test shall be representative for the axle and shall be selected by the vehicle manufacturer and recorded in Annex 9. They shall correspond to one of the tyre sizes designated for the vehicle as original equipment. The tyre is or will be commercially available on the market at the same time as the vehicle ([1]). The tyres shall be inflated to the pressure recommended by the vehicle manufacturer for the test mass of the vehicle. The tyres shall have a tread depth of at least 80 % of the full tread depth.

2.2.3. Before the measurements are started, the engine shall be brought to its normal operating conditions.

2.2.4. If the vehicle is fitted with more than two-wheel drive, it shall be tested in the drive which is intended for normal road use.

2.2.5. If the vehicle is fitted with fan(s) having an automatic actuating mechanism, this system shall not be interfered with during the measurements.

2.2.6. If the vehicle is equipped with an exhaust system containing fibrous materials, the exhaust system is to be conditioned before the test according to Annex 5.

3. METHODS OF TESTING

3.1. **Measurement of noise of vehicles in motion**

3.1.1. *General conditions of test*

Two lines, AA' and BB', parallel to line PP' and situated respectively 10 m forward and 10 m rearward of line PP' shall be marked out on the test runway.

At least four measurements shall be made on each side of the vehicle and for each gear. Preliminary measurements may be made for adjustment purposes, but shall be disregarded.

The microphone shall be located at a distance of 7,5 m ± 0,05 m from the reference line CC' of the track and 1,2 m ± 0,02 m above the ground.

([1]) The tyre contribution for overall sound emission being important, this vehicle Regulation has taken into account the tyre/road sound emission regulations. Snow tyres and special tyres according to UNECE Regulation No 117 should be excluded during typeapproval and COP-measurements on request of the manufacturer.

The reference axis for free field conditions (see IEC 61672-1:2002) shall be horizontal and directed perpendicularly towards the path of the vehicle line CC'.

3.1.2. *Specific test conditions for vehicles*

3.1.2.1. Vehicles of category M_1, $M_2 \leq 3\,500$ kg, N_1

The path of the centreline of the vehicle shall follow line CC' as closely as possible throughout the entire test, from the approach to line AA' until the rear of the vehicle passes line BB'. If the vehicle is fitted with more than two-wheel drive, test it in the drive selection which is intended for normal road use.

If the vehicle is fitted with an auxiliary manual transmission or a multi-gear axle, the position used for normal urban driving shall be used. In all cases, the gear ratios for slow movements, parking or braking shall be excluded.

The test mass of the vehicle shall be according to the table of paragraph 2.2.1.

The test speed v_{test} is 50 km/h ± 1 km/h. The test speed must be reached, when the reference point is at line PP'.

3.1.2.1.1. Power to mass ratio index (PMR)

PMR is defined as follows:

$$PMR = (P_n / m_t) \times 1\,000 \text{ kg/kW}$$

The power to mass ratio index (PMR) is used for the calculation of acceleration.

3.1.2.1.2. Calculation of acceleration

Acceleration calculations are applicable to M_1, N_1 and $M_2 \leq 3\,500$ kg categories only.

All accelerations are calculated using different speeds of the vehicle on the test track ([1]). The formulas given are used for the calculation of $a_{wot\ i}$, $a_{wot\ i+1}$ and $a_{wot\ test}$. The speed either at AA' or PP' is defined as the vehicle speed when the reference point passes AA' ($v_{AA'}$) or PP' ($v_{PP'}$). The speed at BB' is defined when the rear of the vehicle passes BB' ($v_{BB'}$). The method used for determination of the acceleration shall be indicated in the test report.

Due to the definition of the reference point for the vehicle the length of the vehicle (l_{veh}) is considered differently in the formula below. If the reference point is in the front of the vehicle, then $l = l_{veh}$, mid: $l = {}^1/_2\ l_{veh}$ and rear: $l = 0$.

3.1.2.1.2.1. Calculation procedure for vehicles with manual transmission, automatic transmission, adaptive transmissions and transmissions with variable gear ratios (CVTs) tested with locked gear ratios:

$$a_{wot\ test} = ((v_{BB'}/3{,}6)^2 - (v_{AA'}/3{,}6)^2) / (2 \times (20 + l))$$

$a_{wot\ test}$ used in the determination of gear selection shall be the average of the four $a_{wot\ test,\ i}$ during each valid measurement run.

Pre-acceleration may be used. The point of depressing the accelerator before line AA' shall be reported in the vehicle and test data (see Annex 9).

([1]) See Annex 8, Figure 1.

3.1.2.1.2.2. Calculation procedure for vehicles with automatic transmissions, adaptive transmissions and CVTs tested with non-locked gear ratios

$a_{wot\ test}$ used in the determination of gear selection shall be the average of the four $a_{wot\ test,\ i}$ during each valid measurement run.

If devices or measures described in paragraph 3.1.2.1.4.2, can be used to control transmission operation for the purpose of achieving test requirements, calculate $a_{wot\ test}$ using the equation:

$$a_{wot\ test} = ((v_{BB'}/3{,}6)^2 - (v_{AA'}/3{,}6)^2) / (2 \times (20 + l))$$

Pre-acceleration may be used.

If no devices or measures described in paragraph 3.1.2.1.4.2 are used, calculate $a_{wot\ test}$ using the equation:

$$a_{wot\_testPP\text{-}BB} = ((v_{BB'}/3{,}6)^2 - (v_{P'}/3{,}6)^2) / (2 \times (10 + l))$$

Pre-acceleration shall not be used.

The location of depressing the accelerator shall be where the reference point of the vehicle passes line AA'.

3.1.2.1.2.3. Target acceleration

The target acceleration a_{urban} defines the typical acceleration in urban traffic and is derived from statistical investigations. It is a function depending on the PMR of a vehicle.

The target acceleration a_{urban} is defined by:

$$a_{urban} = 0{,}63 \times \log 10\ (PMR) - 0{,}09$$

3.1.2.1.2.4. Reference acceleration

The reference acceleration $a_{wot\ ref}$ defines the required acceleration during the accelerated test on the test track. It is a function depending on the power-to-mass ratio of a vehicle. That function is different for specific vehicle categories.

The reference acceleration $a_{wot\ ref}$ is defined by:

$a_{wot\ ref} = 1{,}59 \times \log_{10}(PMR) - 1.41$ for PMR ≥ 25

$a_{wot\ ref} = a_{urban} = 0{,}63 \times \log_{10}(PMR) - 0{,}09$ for PMR < 25

3.1.2.1.3. Partial power factor k_P

The partial power factor k_P (see paragraph 3.1.3.1) is used for the weighted combination of the test results of the acceleration test and the constant speed test for vehicles of category M_1 and N_1.

In cases other than a single gear test $a_{wot\ ref}$ has to be used instead of $a_{awot\ test}$ (see paragraph 3.1.3.1).

3.1.2.1.4. Gear ratio selection

The selection of gear ratios for the test depends on their specific acceleration potential a_{wot} under full throttle condition, according to the reference acceleration $a_{wot\ ref}$ required for the full throttle acceleration test.

Some vehicles may have different software programs or modes for the transmission (e.g. sporty, winter, adaptive). If the vehicle has different modes leading to valid accelerations, the vehicle manufacturer has to prove to the satisfaction of the technical service, that the vehicle is tested in the mode which achieves an acceleration being closest to $a_{wot\ ref}$.

3.1.2.1.4.1. Vehicles with manual transmission, automatic transmissions, adaptive transmissions or CVTs tested with locked gear ratios

The following conditions for selection of gear ratios are possible:

— if one specific gear ratio gives an acceleration in a tolerance band of ± 5 % of the reference acceleration $a_{wot\ ref}$, not exceeding 2,0 m/s^2, test with that gear ratio,

— if none of the gear ratios give the required acceleration, then choose a gear ratio i, with an acceleration higher and a gear ratio i+1, with an acceleration lower than the reference acceleration. If the acceleration value in gear ratio i does not exceed 2,0 m/s^2, use both gear ratios for the test. The weighting ratio in relation to the reference acceleration $a_{wot\ ref}$ is calculated by:

$$k = (a_{wot\ ref} - a_{wot\ (i+1)}) / (a_{wot\ (i)} - a_{wot\ (i+1)}),$$

— if the acceleration value of gear ratio i exceeds 2,0 m/s^2, the first gear ratio shall be used that gives an acceleration below 2,0 m/s^2 unless gear ratio i+1 provides acceleration less than a_{urban}. In this case, two gears, i and i+1 shall be used, including the gear i with acceleration exceeding 2,0 m/s^2. In other cases, no other gear shall be used. The achieved acceleration $a_{wot\ test}$ during the test shall be used for the calculation of the part power factor k_P instead of $a_{wot\ ref}$,

— if the vehicle has a transmission in which there is only one selection for the gear ratio the acceleration test is carried out in this vehicle gear selection. The achieved acceleration is then used for the calculation of the part power factor k_P instead of $a_{wot\ ref}$,

— if rated engine speed is exceeded in a gear ratio before the vehicle passes BB' the next higher gear shall be used.

3.1.2.1.4.2. Vehicles with automatic transmission, adaptive transmissions and CVTs tested with non-locked gear ratios:

The gear selector position for full automatic operation shall be used.

The acceleration value a_{wot} test shall be calculated as defined in paragraph 3.1.2.1.2.2.

The test may then include a gear change to a lower range and a higher acceleration. A gear change to a higher range and a lower acceleration is not allowed. A gear shifting to a gear ratio which is not used in urban traffic shall be avoided.

Therefore, it is permitted to establish and use electronic or mechanical devices, including alternate gear selector positions, to prevent a downshift to a gear ratio which is typically not used at the specified test condition in urban traffic.

The achieved acceleration a_{wot} test shall be greater or equal to a_{urban}.

If possible, the manufacturer shall take measures to avoid an acceleration value $a_{wot\ test}$ greater than 2,0 m/s^2.

The achieved acceleration $a_{wot\ test}$ is then used for the calculation of the partial power factor k_P (see paragraph 3.1.2.1.3) instead $a_{wot\ ref}$.

3.1.2.1.5. Acceleration test

The manufacturer shall define the position of the reference point in front of line AA' of fully depressing the accelerator. The accelerator shall be fully depressed (as rapidly as is practicable) when the reference point of the vehicle reaches the defined point. The accelerator shall be kept in this depressed condition until the rear of the vehicle reaches line BB'. The accelerator shall then be released as rapidly as possible. The point of fully depressing the accelerator shall be reported in the vehicle and test data (Annex 9). The technical service shall have the possibility of pretesting.

In the case of articulated vehicles consisting of two non-separable units regarded as a single vehicle, the semi-trailer shall be disregarded in determining when line BB' is crossed.

3.1.2.1.6. Constant speed test

The constant speed test shall be carried out with the same gear(s) specified for the acceleration test and a constant speed of 50 km/h with a tolerance of ± 1 km/h between AA' and BB'. During the constant speed test the acceleration control shall be positioned to maintain a constant speed between AA' and BB' as specified. If the gear is locked for the acceleration test, the same gear shall be locked for the constant speed test.

The constant speed test is not required for vehicles with a PMR < 25.

3.1.2.2. Vehicles of categories M_2 > 3 500 kg, M_3, N_2, N_3

The path of the centreline of the vehicle shall follow line CC' as closely as possible throughout the entire test, from the approach to line AA' until the rear of the vehicle passes line BB'. The test shall be conducted without a trailer or semi-trailer. If a trailer is not readily separable from the towing vehicle the trailer shall be ignored when considering the crossing of line BB'. If the vehicle incorporates equipment such as a concrete mixer, a compressor, etc, this equipment shall not be in operation during the test. The test mass of the vehicle shall be according to the table of paragraph 2.2.1.

Target conditions of category M_2 > 3 500 kg, N_2:

When the reference point passes line BB', the engine speed $n_{BB'}$ shall be between 70 % and 74 % of speed S, at which the engine develops its rated maximum power, and the vehicle speed shall be 35 km/h ± 5 km/h. Between line AA' and line BB' a stable acceleration condition shall be ensured.

Target conditions of category M_3, N_3:

When the reference point passes line BB', the engine speed $n_{BB'}$ shall be between 85 % and 89 % of speed S, at which the engine develops its rated maximum power, and the vehicle speed shall be 35 km/h ± 5 km/h. Between line AA' and line BB' a stable acceleration condition shall be ensured.

3.1.2.2.1. Gear ratio selection

3.1.2.2.1.1. Vehicles with manual transmissions

Stable acceleration condition shall be ensured. The gear choice is determined by the target conditions. If the difference in speed exceeds the given tolerance, then two gears should be tested, one above and one below the target speed.

If more than one gear fulfils the target conditions select that gear which is closest to 35 km/h. If no gear fulfils the target condition for v_{test} two gears shall be tested, one above and one below v_{test}. The target engine speed shall be reached in any condition.

A stable acceleration condition shall be ensured. If a stable acceleration cannot be ensured in a gear, this gear has to be disregarded.

3.1.2.2.1.2. Vehicles with automatic transmissions, adaptive transmissions and transmissions with variable gear ratio (CVTs)

The gear selector position for full automatic operation shall be used. The test may then include a gear change to a lower range and a higher acceleration. A gear change to a higher range and a lower acceleration is not allowed. A gear shifting to a gear ratio which is not used in urban traffic, at the specified test condition, shall be avoided. Therefore, it is permitted to establish and use electronic or mechanical devices to prevent a downshift to a gear ratio which is typically not used at the specified test condition in urban traffic.

If the vehicle includes a transmission design, which provides only a single gear selection (drive), which limits engine speed during the test, the vehicle shall be tested using only a target vehicle speed. If the vehicle uses an engine and transmission combination that does not fulfil paragraph 3.1.2.2.1.1, the vehicle shall be tested using only the target vehicle speed. The target vehicle speed for the test is $v_{BB'}$ = 35 km/h ± 5 km/h. A gear change to a higher range and a lower acceleration is allowed after the reference point of the vehicle passes line PP'. Two tests must be performed, one with the end speed of $v_{test} = v_{BB'} + 5$ km/h, and one with the end speed of $v_{test} = v_{BB'} - 5$ km/h. The reported noise level is that result which is related to the test with the highest engine speed obtained during the test from AA' to BB'.

3.1.2.2.2. Acceleration test

When the reference point of the vehicle reaches the line AA' the accelerator control shall be fully depressed (without operating the automatic downshift to a lower range than normally used in urban driving) and held fully depressed until the rear of the vehicle passes BB', but the reference point shall be at least 5 m behind BB'. The accelerator control shall then be released.

In the case of articulated vehicles consisting of two non-separable units regarded as a single vehicle, the semi-trailer shall be disregarded in determining when line BB' is crossed.

3.1.3. *Interpretation of results*

The maximum A-weighted sound pressure level indicated during each passage of the vehicle between the two lines AA' and BB' shall be noted. If a noise peak obviously out of character with the general sound pressure level is observed, the measurement shall be discarded. At least four measurements for each test condition shall be made on each side of the vehicle and for each gear ratio. Left and right side may be measured simultaneously or sequentially. The first four valid consecutive measurement results, within 2 dB(A), allowing for the deletion of non-valid results (see paragraph 2.1), shall be used for the calculation of the final result for the given side of the vehicle. The results of each side shall be averaged separately. The intermediate result is the higher value of the two averages mathematically rounded to the first decimal place.

The speed measurements at AA', BB', and PP' shall be noted and used in calculations to the first significant digit after the decimal place.

The calculated acceleration $a_{wot\ test}$ shall be noted to the second digit after the decimal place.

3.1.3.1. Vehicles of categories M_1, N_1 and $M_2 \leq 3\,500$ kg

The calculated values for the acceleration test and the constant speed test are given by:

$$L_{wot\ rep} = L_{wot\ (i+1)} + k \times (L_{wot(i)} - L_{wot\ (i+1)})$$

$$L_{crs\ rep} = L_{crs(i+1)} + k \times (L_{crs\ (i)} - L_{crs\ (i+1)})$$

Where $k = (a_{wot\ ref} - a_{wot\ (i+1)}) / (a_{wot\ (i)} - a_{wot\ (i+1)})$

In the case of a single gear ratio test the values are the test result of each test.

The final result is calculated by combining $L_{wot\ rep}$ and $L_{crs\ rep}$. The equation is:

$$L_{urban} = L_{wot\ rep} - k_P \times (L_{wot\ rep} - L_{crs\ rep})$$

The weighting factor k_P gives the partial power factor for urban driving. In cases other than a single gear test k_P is calculated by:

$k_P = 1 - (a_{urban} / a_{wot\ ref})$

If only one gear was specified for the test k_P is given by:

$k_P = 1 - (a_{urban} / a_{wot\ test})$

In cases where $a_{wot\ test}$ is less than a_{urban}:

$k_P = 0$

3.1.3.2. Vehicles of categories $M_2 > 3\ 500$ kg, M_3, N_2, N_3

When one gear is tested the final result is equal to the intermediate result. When two gears are tested the arithmetic mean of the intermediate results shall be calculated.

3.2. **Measurement of noise emitted by stationary vehicles**

3.2.1. *Sound level in the vicinity of vehicles*

The measurement results shall be entered into the test report referred to in Annex 9.

3.2.2. *Acoustic measurements*

A precision sound-level meter, or equivalent measuring system, as defined in paragraph 1.1 of this Annex shall be used for the measurements.

3.2.3. *Test site — local conditions (see Appendix to Annex 3, Figure 1)*

3.2.3.1. In the vicinity of the microphone, there shall be no obstacle that could influence the acoustical field and no person shall remain between the microphone and the noise source. The meter observer shall be positioned so as not to influence the meter reading.

3.2.4. *Disturbance sound and wind interference*

Readings on the measuring instruments produced by ambient noise and wind shall be at least 10 dB(A) below the sound level to be measured. A suitable windscreen may be fitted to the microphone provided that account is taken of its effect on the sensitivity of the microphone (see paragraph 1.1 of this Annex).

3.2.5. *Measuring method*

3.2.5.1. Nature and number of measurements

The maximum sound level expressed in A-weighted decibels (dB(A)) shall be measured during the operating period referred to in paragraph 3.2.5.3.2.1.

At least three measurements shall be taken at each measuring point.

3.2.5.2. Positioning and preparation of the vehicle

The vehicle shall be located in the centre part of the test area with the gear selector in the neutral position and the clutch engaged. If the design of the vehicle does not allow this, the vehicle shall be tested in conformity with the manufacturer's prescriptions for stationary engine testing. Before each series of measurements, the engine must be brought to its normal operating condition, as specified by the manufacturer.

If the vehicle is fitted with fan(s) having an automatic actuating mechanism, this system shall not be interfered with during the sound level measurements.

The engine hood or compartment cover, if so fitted, shall be closed.

3.2.5.3. Measuring of noise in proximity to the exhaust (see Appendix to Annex 3, Figure 1)

3.2.5.3.1. Positions of the microphone

3.2.5.3.1.1. The microphone shall be located at a distance of 0,5 m ± 0,01 m from the reference point of the exhaust pipe defined in Figure 1, and at an angle of 45° (± 5°) to the flow axis of the pipe termination. The microphone shall be at the height of the reference point, but not less than 0,2 m from the ground surface. The reference axis of the microphone shall lie in a plane parallel to the ground surface and shall be directed toward the reference point on the exhaust outlet. If two microphone positions are possible, the location farthest laterally from the vehicle longitudinal centreline shall be used. If the flow axis of the exhaust outlet pipe is at 90° to the vehicle longitudinal centreline, the microphone shall be located at the point, which is farthest from the engine.

3.2.5.3.1.2. For vehicles having an exhaust provided with outlets spaced more than 0,3 m apart, measurements shall be made for each outlet. The highest level shall be recorded.

3.2.5.3.1.3. In the case of an exhaust provided with two or more outlets spaced less than 0,3 m apart and which are connected to the same silencer, only one measurement is made; the microphone position is related to the outlet nearest to one extreme edge of the vehicle or, when such outlet does not exist, to the outlet which is the highest above the ground.

3.2.5.3.1.4. For vehicles with a vertical exhaust (e.g. commercial vehicles) the microphone shall be placed at the height of the exhaust outlet. Its axis shall be vertical and oriented upwards. It shall be placed at a distance of 0,5 m ± 0,01 m from the exhaust pipe reference point, but never less than 2 m from the side of the vehicle nearest to the exhaust.

3.2.5.3.1.5. For exhaust outlets located under the vehicle body, the microphone shall be located a minimum of 0,2 m from the nearest part of the vehicle, at a point closest to, but never less than 0,5 m from the exhaust pipe reference point, and at a height of 0,2 m above the ground, and not in line with the exhaust flow. The angularity requirement in paragraph 3.2.5.3.1.2 may not be met in some cases.

3.2.5.3.2. Operating conditions of the engine

3.2.5.3.2.1. Target engine speed

The target engine speed is defined as:

— 75 % of the engine speed S for vehicles with a rated engine speed ≤ 5 000 min^{-1}

— 3 750 min^{-1} for vehicles with a rated engine speed above 5 000 min^{-1} and below 7 500 min^{-1}

— 50 % of the engine speed S for vehicles with a rated engine speed ≥ 7 500 min^{-1}.

If the vehicle cannot reach the engine speed as stated above, the target engine speed shall be 5 % below the maximum possible engine speed for that stationary test.

3.2.5.3.2.2. Test procedure

The engine speed shall be gradually increased from idle to the target engine speed, not exceeding a tolerance band of ± 3 % of the target engine speed, and held constant. Then the throttle control shall be rapidly released and the engine speed shall return to idle. The noise level shall be measured during a period of operation consisting of a maintenance of constant engine speed of one second and throughout the entire deceleration period, the maximum sound-level meter reading, mathematically rounded to the first decimal place, is taken as the test value.

3.2.5.3.2.3. Test validation

The measurement shall be regarded as valid if the test engine speed does not deviate from the target engine speed by more than ± 3 % for at least one second.

3.2.6. *Results*

At least three measurements for each test position shall be made. The maximum A-weighted sound pressure level indicated during each of the three measurements shall be recorded. The first three valid consecutive measurement results, within 2 dB(A), allowing for the deletion of non valid results (see paragraph 2.1 except the specifications of the test site), shall be used for the determination of the final result for the given measurement position. The maximum sound level, for all measurement positions, and of the three measurement results, constitutes the final result.