

15 February 2023

Agreement

Concerning the Adoption of Harmonized Technical United Nations Regulations 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 United Nations Regulations*

(Revision 3, including the amendments which entered into force on 14 September 2017)

Addendum 52 – UN Regulation No. 53

Revision 5 – Amendment 3

Supplement 3 to the 03 series of amendments – Date of entry into force: 4 January 2023

Uniform provisions concerning the approval of category L₃ vehicles with regard to the installation of lighting and light-signalling devices

This document is meant purely as documentation tool. The authentic and legal binding text is: ECE/TRANS/WP.29/2022/100 (as amended by paragraph. 142 of the report ECE/TRANS/WP.29/1166).



UNITED NATIONS

* Former titles of the Agreement:

Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958 (original version); 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, done at Geneva on 5 October 1995 (Revision 2).

Insert a new paragraph 2.21., to read:

"2.21. "Adaptive Driving-Beam" (or "ADB") means a front lighting system consisting of driving-beam(s) only and type-approved according to UN Regulation No. 149 that adapts its beam pattern to the presence of oncoming and preceding vehicles in order to improve the long-range visibility for the driver without causing discomfort, distraction or glare to other road users.

Unless otherwise specified, administrative and technical provisions for the driving-beam function of the adaptive front lighting system (AFS) in UN Regulation No. 149 shall apply to ADB.

2.21.1. "ADB neutral state" means the state of the ADB when the driving-beam is in the maximum condition of activation."

Insert a new paragraph 3.2.7., to read:

"3.2.7. Where an ADB is fitted on the vehicle, the applicant shall submit a detailed description providing the following information:

3.2.7.1. The technical characteristics relevant to the operation of ADB;

3.2.7.2. Special instruction, if any, for the inspection of the light sources and the visual observation of the beam;

3.2.7.3. The lamps that are grouped or combined with or reciprocally incorporated in the ADB."

Paragraph 5.4., amend to read:

"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, its median longitudinal plane being vertical and the handlebars being in the position corresponding to the straight ahead movement. The tyre pressures shall be those prescribed by the manufacturer for the particular conditions of loading required in this Regulation.

In the case where an ADB is installed, with the system in its ADB neutral state."

Paragraph 5.13., amend to read:

"5.13. Colours of the lights

The colours of the lights referred to in this Regulation shall be as follow:

Driving-beam headlamp: white

Passing-beam headlamp: white

Direction-indicator lamp: amber

Stop lamp: red

Rear-registration plate lamp: white

Front position lamp: white or amber

Rear position lamp: red

Rear retro-reflector, non-triangular: red

Side retro-reflector, non-triangular: amber at the front

amber or red at the rear

Vehicle-hazard warning signal: amber

Front fog lamp: white or selective yellow

Rear fog lamp: red

Daytime running lamp	white
Emergency stop signal:	amber or red
Exterior courtesy lamp:	white
Adaptive Driving-Beam (ADB):	white"

Insert a new paragraph 5.15.7., to read:

"5.15.7. Adaptive Driving-Beam (ADB) (paragraph 6.16.)."

Insert a new paragraph 5.23., to read:

"5.23. Where an ADB is fitted, it shall be considered equivalent to the driving-beam headlamp(s)."

Paragraph 6.1.3.1.1., amend to read:

"6.1.3.1.1. An independent driving lamp may be fitted above or below or to one side of another front lamp: if these lamps are on top of the other the reference centre of the driving lamp must be located within the median longitudinal plane of the vehicle; if these lamps are side by side their reference centre must be symmetrical in relation to the median longitudinal plane of the vehicle."

Paragraph 6.1.6., amend to read:

"6.1.6. Electrical connections

6.1.6.1. The passing-beam(s) may remain switched ON with the driving-beam(s).

However, when the vehicle is fitted with secondary driving-beam(s) approved in accordance with UN Regulations Nos. 113 or 149, at least one of the following lamps shall remain switched ON with the secondary driving beam(s):

- (a) Passing-beam(s);
- (b) Primary driving-beam approved according to UN Regulations Nos. 113 or 149;
- (c) Driving-beam of Class A or B approved according to the 01 and subsequent series of amendments to UN Regulation No. 149.

6.1.6.2. The control of the driving-beam headlamp(s) may be automatic regarding their switching ON and OFF, the control signals being produced by a sensor system which is capable of detecting and reacting to each of the following inputs:

- (a) Ambient lighting conditions;
- (b) The light emitted by the front lighting devices and front light-signalling devices of oncoming vehicles;
- (c) The light emitted by the rear light-signalling devices of preceding vehicles.

Additional sensor functions to improve performance are allowed.

For the purpose of this paragraph, "vehicles" means vehicles of categories L, M, N, O, T, as well as bicycles, such vehicles being equipped with retro-reflectors, with lighting and light-signalling devices, which are switched ON.

6.1.6.3. It shall always be possible to switch the driving-beam headlamp(s) ON and OFF manually and to manually deactivate the automatic control of the driving-beam headlamp(s). Moreover, the switching OFF, of the driving-beam headlamp(s) and the deactivation of their automatic control, shall be by means of a simple and immediate manual operation; the use of submenus is not allowed."

Insert a new paragraph 6.1.7.3., to read:

- "6.1.7.3. If the control of the driving-beam headlamp(s) is automatic, an indication shall be provided to the driver that the automatic control of the driving-beam function is activated. This information shall remain displayed as long as the automatic operation is activated."

Insert a new paragraph 6.1.8.3., to read:

- 6.1.8.3. Automatic switching ON and OFF of the driving-beam headlamp(s):
- 6.1.8.3.1. The sensor system used to control the automatic switching ON and OFF of the driving-beam headlamp(s) shall comply with the following requirements:
- 6.1.8.3.1.1. The boundaries of the minimum fields in which the sensor is able to detect light emitted from other vehicles defined in paragraph 6.1.6.2. above are defined by the angles indicated below.
- 6.1.8.3.1.1.1. Horizontal angles: 15 degrees to the left and 15 degrees to the right.
Vertical angles: 5 degrees upwards and 2 degrees downwards.
These angles are measured from the centre of the sensor aperture relative to a horizontal straight line through its centre and parallel to the longitudinal median plane of the vehicle.
- 6.1.8.3.1.2. The sensor system shall be able to detect on a straight level road:
- (a) An oncoming power driven vehicle at a distance extending to at least 400 m;
- (b) A preceding power driven vehicle or a vehicle-trailers combination at a distance extending to at least 100 m;
- (c) An oncoming bicycle at a distance extending to at least 75 m, its illumination represented by a white lamp with a luminous intensity of 150 cd with a light emitting area of $10 \pm 3 \text{ cm}^2$ and a height above a ground of 0.8 m.
- To verify compliance with (a) and (b) above, the oncoming and preceding power driven vehicle (or vehicle-trailer combination) shall have position lamps (if applicable) and passing-beam headlamp(s) switched ON.
- 6.1.8.3.2. The transition from driving-beam to passing-beam and vice versa may be performed automatically and shall not cause discomfort, distraction or glare.
- 6.1.8.3.3. The overall performance of the automatic control shall be verified by:
- 6.1.8.3.3.1. Means of simulation or other means of verification accepted by the Type Approval Authority, as provided by the applicant.
- 6.1.8.3.3.2. A test drive according to paragraph 1 in Annex 9. The performance of the automatic control shall be documented and checked against the applicant's description. Any obvious malfunctioning shall be contested (e. g. excessive angular movement or flicker).
- 6.1.8.3.4. The control of the driving-beam headlamp(s) may be such that the driving-beam headlamp(s) are switched ON automatically only when:
- (a) No vehicles, as mentioned in paragraph 6.1.6.2. above, are detected within the fields and distances according to paragraphs 6.1.8.3.1.1. and 6.1.8.3.1.2.; and
- (b) The detected ambient lighting levels are as prescribed in paragraph 6.1.8.3.5. below.
- 6.1.8.3.5. In the case where driving-beam headlamp(s) are switched ON automatically, they shall be switched OFF automatically when oncoming or preceding

vehicles, as mentioned in paragraph 6.1.6.2. above, are detected within the fields and distances according to paragraphs 6.1.8.3.1.1. and 6.1.8.3.1.2.

Moreover, they shall be switched OFF automatically when the illuminance produced by ambient lighting conditions exceeds 7000 lx.

Compliance with this requirement shall be demonstrated by the applicant, using simulation or other means of verification accepted by the Type Approval Authority. If necessary the illuminance shall be measured on a horizontal surface, with a cosine corrected sensor on the same height as the mounting position of the sensor on the vehicle. This may be demonstrated by the manufacturer by sufficient documentation or by other means accepted by the Type Approval Authority."

Paragraph 6.2.1.1., amend to read:

"6.2.1.1. For motorcycles having a cylinder capacity $\leq 125 \text{ cm}^3$

One or two of approved type according to:

- (a) Class C, D or E of UN Regulation No. 113;
- (b) UN Regulation No. 112;
- (c) UN Regulation No. 1;
- (d) UN Regulation No. 8;
- (e) UN Regulation No. 20;
- (f) UN Regulation No. 57;
- (g) UN Regulation No. 72;
- (h) UN Regulation No. 98.
- (i) Class A, D, CS, DS or ES of UN Regulation No. 149;
- (j) Class C or V of the 01 and subsequent series of amendments to UN Regulation No. 149."

Paragraph 6.2.1.2., amend to read:

"6.2.1.2. For motorcycles having a cylinder capacity $> 125 \text{ cm}^3$

One or two of approved type according to:

- (a) Class D or E of UN Regulation No. 113;
- (b) UN Regulation No. 112;
- (c) UN Regulation No. 1;
- (d) UN Regulation No. 8;
- (e) UN Regulation No. 20;
- (f) UN Regulation No. 72;
- (g) UN Regulation No. 98.
- (h) Class A, D, DS or ES of UN Regulation No. 149;
- (i) Class C or V of the 01 and subsequent series of amendments to UN Regulation No. 149.

Two of approved type according to:

- (j) Class C of UN Regulation No. 113;
- (k) Class CS of UN Regulation No. 149."

Paragraph 6.2.3.1.4., amend to read:

"6.2.3.1.4. If installed, additional lighting unit(s) which provide bend lighting, type approved as part of the passing-beam according to UN Regulation No. 113 or 149, shall be installed under the following conditions:

In the case of (a) pair(s) of additional lighting units, they shall be installed so that their reference centre(s) are symmetrical in relation to the median longitudinal plane of the vehicle.

In the case of a single additional lighting unit, its reference centre shall be coincident with the median longitudinal plane of the vehicle."

Paragraph 6.13.4.1.1., amend to read:

"6.13.4.1.1. An independent daytime running lamp may be installed above, below or to one side of another front lamp: If these lamps are one above the other, the reference centre of the daytime running lamp shall be located within the median longitudinal plane of the vehicle; if these lamps are side by side, the edge of the illuminating surface shall not be more than 250 mm from the median longitudinal plane of the vehicle."

Insert a new paragraph 6.16., to read:

"6.16. Adaptive Driving-Beam (ADB) (UN Regulation No. 149)

Where not otherwise specified below, the requirements for driving-beam headlamp(s) (paragraph 6.1.) of this Regulation apply to the ADB.

6.16.1. Number

6.16.1.1. One.

6.16.1.2. Installation units shall be one or two.

6.16.2. Arrangement

No special requirements.

6.16.3. Position

The ADB shall, prior to the subsequent test procedures, be set to the ADB neutral state;

6.16.3.1. In width and height:

All dimensions refer to the nearest edge of the apparent surface(s) observed in the direction of the reference axis, of the installation unit(s).

6.16.3.1.1. An independent ADB installation unit may be fitted above or below or to one side of another front lamp: if these lamps are on top of the other the reference centre of the ADB installation unit must be located within the median longitudinal plane of the vehicle; if these lamps are side by side their reference centre must be symmetrical in relation to the median longitudinal plane of the vehicle.

6.16.3.1.2. An ADB installation unit, that is reciprocally incorporated with another front lamp, must be fitted in such a way that its reference centre lies within the median longitudinal plane of the vehicle. However, when the vehicle is also fitted with an independent principal passing-beam headlamp, or a principal passing-beam headlamp that is reciprocally incorporated with a front position lamp alongside the ADB installation unit, their reference centres must be symmetrical in relation to the median longitudinal plane of the vehicle.

6.16.3.1.3. Two ADB installation units of which either one or both are reciprocally incorporated with another front lamp must be fitted in such a way that their reference centres are symmetrical in relation to the median longitudinal plane of the vehicle.

- 6.16.3.2. In length: at the front of the vehicle. This requirement is regarded as satisfied if the light emitted does not cause discomfort to the driver either directly or indirectly by means of the rear-view mirrors and/or reflective surfaces on the vehicle.
- 6.16.3.3. In any case, the distance between the edge of the illuminating surface of any independent ADB installation unit and the edge of that of the lamp producing the principal passing-beam must not exceed 200 mm. The distance between the edge of the illuminating surface of any independent ADB installation unit and the ground must be from 500 mm to 1,300 mm.
- 6.16.3.4. In the case of two ADB installation units: the distance separating the illuminating surfaces of two ADB installation units must not exceed 200 mm.
- 6.16.4. Geometric visibility
The angles of geometric visibility specified in paragraph 6.1.4. of this Regulation, shall be met by at least one of the installation units said function, according to the description of the applicant. Individual installation units may be used to comply with the requirements for different angles.
- 6.16.5. Orientation
Towards the front.
- 6.16.5.1. The vertical inclination of the center of the area of maximum illumination of ADB shall remain between ± 0.5 per cent, except in the case where an external adjusting device is present.
In case ADB is adjusted together with the passing-beam(s), this provision shall not apply.
- 6.16.6. Electrical connections
- 6.16.6.1. For changing over from the ADB to the passing-beam all lighting units for the driving-beam shall be de-activated simultaneously.
- 6.16.6.2. The ADB shall be designed to be adaptive, subject to the provisions in paragraph 6.16.8.1., the control signals being produced by a sensor system which is capable of detecting and reacting to each of the following inputs:
- (a) Ambient lighting conditions;
 - (b) The light emitted by the front lighting devices and front light-signalling devices of oncoming vehicles;
 - (c) The light emitted by the rear light-signalling of preceding vehicles;
- Additional sensor functions to improve performance are allowed.
For the purpose of this paragraph, "vehicles" means vehicles of categories L, M, N, O, T, as well as bicycles, such vehicles being equipped with retro-reflectors, with lighting and light-signalling devices, which are switched ON.
- 6.16.6.3. It shall always be possible to activate and deactivate the ADB manually, and to manually deactivate the automatic control.
Moreover, the deactivation, of the ADB and of their automatic control, shall be by means of a simple and immediate manual operation; the use of sub-menus is not allowed.
- 6.16.6.4. The passing-beam(s) may remain switched ON at the same time as the ADB.
- 6.16.6.5. It shall always be possible for the driver to set the ADB to the ADB neutral state and to return it to its automatic operation.

- 6.16.7. Tell-tale:
- 6.16.7.1. The provisions of paragraphs 6.1.7. (for the driving-beam headlamp(s)) of this Regulation apply to the respective parts of an ADB.
- 6.16.7.2. A visual failure tell-tale for ADB is mandatory. It shall be non-flashing. It shall be activated whenever a failure signal is received in accordance with paragraph 4.13. of UN Regulation No. 149. It shall remain activated while the failure is present. It may be cancelled temporarily, but shall be repeated whenever the device which starts and stops the engine is switched ON and OFF.
- 6.16.7.3. A visual tell-tale shall be provided to indicate to the driver that the adaptation of the driving-beam is activated. This information shall remain displayed as long as the adaptation is activated.
- 6.16.8. Other requirements
- 6.16.8.1. Adaptation of the driving-beam
- 6.16.8.1.1. The sensor system used to control the adaptation of the driving-beam, as described in paragraph 6.16.6.2. above, shall comply with the following requirements:
- 6.16.8.1.1.1. The boundaries of the minimum fields in which the sensor is able to detect light emitted from other vehicles as defined in paragraph 6.16.6.2. above are given by the angles indicated in paragraph 6.1.8.3.1.1. of this Regulation.
- 6.16.8.1.1.2. The sensor system sensitivity shall comply with the requirements in paragraph 6.1.8.3.1.2. of this Regulation.
- 6.16.8.1.1.3. The adaptive driving-beam shall be switched OFF when the illuminance produced by ambient lighting conditions exceeds 7,000 lx.
- Compliance with this requirement shall be demonstrated by the applicant, using simulation or other means of verification accepted by the Type Approval Authority. If necessary, the illuminance shall be measured on a horizontal surface, with a cosine corrected sensor on the same height as the mounting position of the sensor on the vehicle. This may be demonstrated by the manufacturer by sufficient documentation or by other means accepted by the Type Approval Authority.
- 6.16.8.1.1.4. The overall performance of the automatic control shall be demonstrated by the applicant by documentation or by other means accepted by the Type Approval Authority. Furthermore, the manufacturer shall provide a documentation package which gives access to the design of "the safety concept" of the system. This "safety concept" is a description of the measures designed into the system, for example within the electronic units, so as to address system integrity and thereby ensure safe operation even in the event of mechanical or electrical failure which could cause any discomfort, distraction or glare, either to the driver or to oncoming and preceding vehicles. This description shall also give a simple explanation of all the control functions of the "system" and the methods employed to achieve the objectives, including a statement of the mechanism(s) by which control is exercised. The "safety concept" shall describe the measures taken to ensure that failure mode is triggered if any external agent (e.g. caused by dirt) obscures the sensor input.

A list of all input and sensed variables shall be provided and the working range of these shall be defined.

The functions of the system and the safety concept, as laid down by the manufacturer, shall be explained. The documentation shall be brief, yet provide evidence that the design and development has had the benefit of expertise from all the system fields which are involved.

For periodic technical inspections, the documentation shall describe how the current operational status of the "system" can be checked.

For Type Approval purposes this documentation shall be taken as the basic reference for the verification process.

6.16.8.1.1.5. To verify, that the adaptation of the driving-beam does not cause any discomfort, distraction or glare, neither to the driver nor to oncoming and preceding vehicles, the technical service shall perform a test drive according to paragraph 2. in Annex 9. This shall include any situation relevant to the system control on the basis of the applicant's description. The performance of the adaptation of the driving-beam shall be documented and checked against the applicant's description. Any obvious malfunctioning shall be contested (e.g. excessive angular movement or flicker).

6.16.8.2. The aggregate maximum intensity of the lighting units that can be energized simultaneously to provide the driving-beam lighting or its modes, if any, shall not exceed 430,000 cd, which corresponds to a reference value of 100.

This maximum intensity shall be obtained by adding together the individual reference marks indicated on the installation units that are simultaneously used to provide the driving-beam."

Insert a new Annex 9, to read:

"Annex 9

Test drive

1. Test drive specifications for the automatic control of the driving-beam headlamp(s).
 - 1.1. The test drive shall be carried out in clear atmosphere¹ and with clean headlamp(s).
 - 1.2. The test course shall comprise test sections with traffic conditions, at speed corresponding to the relevant type of road, as described in Table 1 below:

Table 1

Test Section	Traffic conditions	Road type		
		Urban areas	Multi-lane road, e.g. motorway	Country road
	Speed	50 ± 10 km/h	100 ± 20 km/h	80 ± 20 km/h
	Average percentage of the full test course length	10 per cent	20 per cent	70 per cent
A	Single oncoming vehicle or single preceding vehicle in a frequency so that the driving-beam will switch ON and OFF.		X	X
B	Combined oncoming and preceding traffic situations, in a frequency so that the driving-beam will switch ON and OFF.		X	X
C	Active and passive overtaking manoeuvres, in a frequency so that the driving-beam will switch ON and OFF.		X	X

Test Section	Traffic conditions	Road type		
		Urban areas	Multi-lane road, e.g. motorway	Country road
	Speed	50 ± 10 km/h	100 ± 20 km/h	80 ± 20 km/h
Average percentage of the full test course length	10 per cent	20 per cent	70 per cent	
D	Oncoming bicycle, as described in paragraph 6.1.8.3.1.2.			X
E	Combined oncoming and preceding traffic situations	X		

- 1.3. Urban areas shall comprise roads with and without illumination.
- 1.4. Country roads shall comprise sections having two lanes and sections having four or more lanes and shall include junctions, hills and/or slopes, dips and winding roads.
- 1.5. Multi-lane roads (e.g. motorways) and country roads shall comprise sections having straight level parts with a length of more than 600 m. Additionally they shall comprise sections having curves to the left and to the right.
- 1.6. Dense traffic situations shall be taken into account.
2. Test drive specifications for adaptive driving-beam headlamp(s)
 - 2.1. The test drive shall be carried out in clear atmosphere¹ and with clean headlamp(s).
 - 2.2. The test course shall comprise test sections with traffic conditions, at speed corresponding to the relevant type of road, as described in Table 2 below:

Table 2

Test Section	Traffic conditions	Road type		
		Urban areas	Multi-lane road, e.g. motorway	Country road
	Speed	50 ± 10 km/h	100 ± 20 km/h	80 ± 20 km/h
Average percentage of the full test course length	10 per cent	20 per cent	70 per cent	
A	Single oncoming vehicle or single preceding vehicle in a frequency so that the adaptive driving-beam will react to demonstrate the adaptation process.		X	X
B	Combined oncoming and preceding traffic situations. In a frequency so that the adaptive driving-beam will react to demonstrate the adaptation process.		X	X
C	Active and passive overtaking manoeuvres, in a frequency so that the adaptive driving-beam will react to demonstrate the adaptation process.		X	X

¹ Good visibility (meteorological optical range MOR > 2,000 m defined according to WMO, Guide to Meteorological Instruments and Methods of Observation, Sixth Edition, ISBN: 92-63-16008-2, pp 1. 9. 1/ 1. 9. 11, Geneva 1996).

	<i>Traffic conditions</i>	<i>Road type</i>		
		<i>Urban areas</i>	<i>Multi-lane road, e.g. motorway</i>	<i>Country road</i>
<i>Test Section</i>	<i>Speed</i>	<i>50 ± 10 km/h</i>	<i>100 ± 20 km/h</i>	<i>80 ± 20 km/h</i>
	<i>Average percentage of the full test course length</i>	<i>10 per cent</i>	<i>20 per cent</i>	<i>70 per cent</i>
D	Oncoming bicycle, as described in paragraph 6.16.8.1.1.2.			X
E	Combined oncoming and preceding traffic situations	X		

- 2.3. Urban areas shall comprise roads with and without illumination.
- 2.4. Country roads shall comprise sections having two lanes and sections having four or more lanes and shall include junctions, hills and/or slopes, dips and winding roads.
- 2.5. Multi lane roads (e.g. motorways) and country roads shall comprise sections having straight level parts with a length of more than 600 m. Additionally they shall comprise of sections having curves to the left and to the right.
- 2.6. Dense traffic situations shall be taken into account.
- 2.7. For the test sections A and B in the table above the engineers conducting the tests shall evaluate and record the acceptability of the performance of the adaptation process in relation to oncoming and preceding road users. This means that the test engineers shall operate the vehicle being tested and additionally operate the oncoming and preceding vehicles.

At the request of the Type Approval Authority, compliance with traffic scenarios other than the ones listed in Table 2 may be demonstrated by the manufacturer by providing sufficient documentation or by other means accepted by the Type Approval Authority."