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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 164 – UN Regulation No. 165

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Uniform provisions concerning the approval of audible reverse warning devices and of motor vehicles with regard to their audible reverse warning signals

This document is meant purely as documentation tool. The authentic and legal binding text is: ECE/TRANS/WP.29/2022/88.



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).

UN Regulation No. 165

Uniform provisions concerning the approval of audible reverse warning devices and of motor vehicles with regard to their audible reverse warning signals

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1. Scope

- 1.1. This Regulation applies to:
 - 1.1.1. PART I: Approval of audible reverse warning devices which are intended for fitting to motor vehicles of categories M₂ (M > 3500 kg), N₂, N₃ and M₃;¹
 - 1.1.2. PART II: Approval of motor vehicles listed in 1.1.1. with regard to fitting of audible reverse warning devices automatically activated when reverse gear is selected and the propulsion system is on.

2. Definitions

For the purpose of this Regulation:

- 2.1. "*Audible reverse warning device*" means a device, emitting an acoustic signal to the outside of a vehicle while reversing, which is intended to give audible warning of the presence of a vehicle, with the primary purpose to fulfil the requirements of this Regulation;
 - 2.1.1. "*Non-self-adjusting audible reverse warning device*" means a device which gives audible reverse warning sound independent of "*Ambient noise*" levels.
 - 2.1.2. "*Self-adjusting audible reverse warning device*" means a device which automatically adjusts its sound level, throughout a defined range, in order to maintain a sound level differential between the sound output of the device and the "*Ambient noise*" measured by itself.
 - 2.1.3. "*Stepwise self-adjusting audible reverse warning device*" means a device which automatically adjusts to a fixed sound level (covering *Low level*, *Normal level* or *High level*), depending on the "*Ambient noise*" measured by itself.
 - 2.1.4. "*Multiple audible reverse warning system*" means a combination of "*Non-self-adjusting audible reverse warning devices*" capable of functioning independently when applying "*Low level*", "*Normal level*", "*High level*";
- 2.2. "*Low level*" mode means the emitted sound level of the "*Audible reverse warning device*" which is to aid sufficient safety of vulnerable road users during quiet times and/or quiet areas.²
- 2.3. "*Normal level*" mode means the emitted sound level of the "*Audible reverse warning device*" which is to aid the sufficient safety of vulnerable road users during normal traffic hours and areas not covered by 2.2. and 2.4.
- 2.4. "*High level*" mode means the emitted sound level of the "*Audible reverse warning device*" which is to aid sufficient safety of vulnerable road users and when "*Normal level*" is deemed insufficient for safety, during times and/or areas not covered by 2.2 and 2.3 (e.g. industrial or road construction sites).
- 2.5. Basic designation for "*Non-self-adjusting audible reverse warning device*"
 - 2.5.1. Class L: The "*Non-self-adjusting audible reverse warning device*" is able to emit sound levels of "*Low level*" only.
 - 2.5.2. Class N: The "*Non-self-adjusting audible reverse warning device*" is able to emit sound levels of "*Normal level*" only.
 - 2.5.3. Class H: The "*Non-self-adjusting audible reverse warning device*" is able to emit sound levels of "*High level*" only.

¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.6, para. 2 - <https://unece.org/transport/standards/transport/vehicle-regulations-wp29/resolutions>

² The "*Low level*" mode would provide the driver the tool to avoid complaints in quiet situations that otherwise could result from the "*Normal level*" mode.

- 2.5.4. Class I: The "*Non-self-adjusting audible reverse warning device*" is able to emit sound levels of "*Low level*" and "*Normal level*".
- 2.5.5. Class II: The "*Non-self-adjusting audible reverse warning device*" is able to emit sound levels of "*Normal level*" and "*High level*".
- 2.5.6. Class III: The "*Non-self-adjusting audible reverse warning device*" is able to emit sound levels of "*Low level*", "*Normal level*" and "*High level*".
- 2.6. Basic designation for "*Multiple audible reverse warning system*"
- 2.6.1. Class M-I: The "*Multiple audible reverse warning system*" is able to emit sound levels of "*Low level*" and "*Normal level*".
- 2.6.2. Class M-II: The "*Multiple audible reverse warning system*" is able to emit sound levels of "*Normal level*" and "*High level*".
- 2.6.3. Class M-III: The "*Multiple audible reverse warning system*" is able to emit sound levels of "*Low level*", "*Normal level*" and "*High level*".
- 2.7. Basic designation for audible reverse warning sound
- 2.7.1. "*Tonal sound*" means a sound, which contains basically a single frequency, which is described as a tone commonly in the frequency range from 500 Hz to 4000 Hz
- 2.7.2. "*Broadband sound*" means a sound, which contains a large number of single frequency components, continuously distributed over a required frequency range covering at least 1000 Hz to 4000 Hz
- 2.7.3. "*One-third octave band sound*" means a sound which is defined as an acoustic signal, which has its main energy and nearly constant power spectral density in 1 of 7 one-third octave frequency bands (Center frequency: 800, 1000, 1250, 1600, 2000, 2500 or 3150 Hz).
- 2.8. Background and ambient noise
- 2.8.1. "*Background noise*" is any disturbing sound other than the sound signal of the audible reverse warning device at test conditions in this regulation. Its sound pressure level is measured in dB(A) and the area considered around the vehicle is regarded as a homogeneous sound field with the same sound pressure level.
- 2.8.2. "*Ambient noise*" is any disturbing sound other than the sound signal of the audible reverse warning device, around the audible reverse warning device and the vehicle. Its sound pressure level is measured in dB(A) and the area considered around the vehicle is regarded as a homogeneous sound field with the same sound pressure level.
- 2.9. "*Reference sound*" is the sound, other than the "*Background noise*" or the warning sound, that is applied at the test situation (see 6.4.2., 14.5.6. and 14.5.7.), and to which the self-adjusting and stepwise self-adjusting audible reverse warning device will adapt.
- 2.10. "*Type of audible reverse warning device*" means audible reverse warning devices not differing essentially from each other with respect to such matters as:
 - 2.10.1. Trade name or mark;
 - 2.10.2. Basic designation
 - 2.10.2.1. Principle of *audible reverse warning device* ("*Non-self-adjusting*", "*Self-adjusting*", or "*Stepwise self-adjusting*")
 - 2.10.2.2. Principle of sound ("*Tonal sound*", "*Broadband sound*", or "*One-third octave band sound*")

2.11. Table 1. Symbols and Abbreviations

L_{corr}	dB(A)	Paragraphs 14.4.5.2. and 14.5.5.2.	Background noise correction
L_{test}	dB(A)	Paragraphs 14.4.5.2. and 14.5.5.2.	A-weighted sound pressure level result of test
$L_{test, corr}$	dB(A)	Paragraphs 14.4.5.2. and 14.5.5.2.	A-weighted sound pressure level result of test corrected for background noise
L_{bgn}	dB(A)	Paragraphs 14.4.5.1. and 14.5.5.1.	Background A-weighted sound pressure level.
$\Delta L_{bgn, p-p}$	dB(A)	Paragraphs 14.4.5.1. and 14.5.5.1.	Range of maximum to minimum value of the representative background noise A-weighted sound pressure level over a defined time period.
ΔL	dB(A)	Paragraphs 14.4.5.2. and 14.5.5.2.	A-weighted sound pressure level of test result minus the A-weighted background noise level ($\Delta L = L_{test} - L_{bgn}$)

I. Part I. Audible reverse warning device

3. Application for approval

- 3.1. The application for approval of a type of audible reverse warning device shall be submitted by its manufacturer or by his duly accredited representative.
- 3.2. It shall be accompanied by a duly filled technical information document, either in paper format in triplicate or alternatively upon agreement with the Type Approval Authority in electronic format. A model of the technical information document is shown in Annex 1A.
- 3.3. In addition, the application for approval shall be accompanied by two samples of the type of audible reverse warning device.
- 3.4. The Type Approval 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. Audible reverse warning devices excluding mounting accessories, shall bear:
 - 4.1.1. The trade name or mark of the manufacturer and the model commercial name and/or number;
 - 4.1.2. The approval mark according to paragraph 5.4.
- 4.2. The approval mark shall be shown on the audible reverse warning device according to paragraph 5.4. Each sample shall have a space of adequate dimensions for the approval mark; this space shall be indicated in the drawing.
- 4.3. All markings shall be clearly legible and indelible.

5. Approval

- 5.1. If the two samples submitted for approval conform to the provisions of paragraph 6. below, approval for this type of audible reverse warning device shall be granted.
- 5.2. An approval number shall be assigned to each type approved. Its first two digits (at present 00 for the UN Regulation in its original form) shall indicate the series of amendments incorporating the most recent major technical amendments made to the UN Regulation at the time of issue of the approval.

The same Contracting Party may not assign this number to another type of audible reverse warning device.

- 5.3. Communication on approval or refusal or extension or withdrawal of approval or production definitely discontinued of a type of audible reverse warning device pursuant to this UN Regulation shall be communicated to the Parties to the Agreement applying this UN Regulation by means of a form conforming to the model in Annex 1A to the UN Regulation.
- 5.4. On every audible reverse warning device which conforms to a type approved under this Regulation, there shall be affixed conspicuously, in an easily accessible place indicated on the approval form, an international approval mark comprising:
 - 5.4.1. A circle containing the letter "E" followed by the distinguishing number of the country granting approval³;
 - 5.4.2. An approval number;
 - 5.4.3. An additional symbol in the form of a figure in letter or Roman numerals, showing the class to which the audible reverse warning device belongs.
- 5.5. Annex 2, Section I. and Section II. to this Regulation give examples of the arrangement of the approval mark.
- 5.6. The Type Approval Authority or its duly accredited technical service shall verify the arrangements of the marks for ensuring effective control of the conformity of production before type approval is granted.

6. Specifications

- 6.1. General specifications
 - 6.1.1. The "*Audible reverse warning device*" shall emit an acoustic signal.

The pattern of the acoustic signal, including at least one silent part, shall be repeatable with 24 to 120 cycles per minute.

For audible reverse warning devices supplied with alternating current, this requirement shall apply only at constant generator speed, within the range specified in paragraph 6.3.4.2.

The type approval tests shall be carried out on two samples of each type submitted by the manufacturer for approval; both the samples shall be subjected to all the tests and must conform to the technical specifications laid down.
 - 6.1.2. The audible reverse warning device shall have acoustic characteristics and mechanical characteristics such that it passes, in the order indicated, the tests according to either paragraph 6.3. or 6.4. as well as paragraphs 6.5. and 6.6.
 - 6.1.3. Alternative sounds

The manufacturer may define alternative sounds, which can be selected by the driver; each of these sounds shall be in compliance and approved with the provisions in either paragraph 6.3. or 6.4. as well as paragraphs 6.5. and 6.6.
- 6.2. Measuring instruments
 - 6.2.1. Acoustic measurements

³ The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev. 6, Annex 3 - <https://unece.org/transport/standards/transport/vehicle-regulations-wp29/resolutions> .

- 6.2.1.1. When no general statement or conclusion can be made about conformance of the sound level meter model to the full specifications of IEC 61672-1:2013,⁴ the apparatus used for measuring the sound pressure level shall be a sound level meter or equivalent measurement system meeting the requirements of Class 1 instruments as described in IEC 61672-3:2013⁴. Measurements shall be carried out using the "fast" response of the acoustic measurement instrument and the "A" weighting curve as described in IEC 61672-1:2013⁴. 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.

When measuring the rated sound frequency (or frequency range), the digital sound recording system shall have at least a 16-bit quantization. The average auto power spectrum shall be determined, using a Hanning window and at least 66.6 per cent overlap averages and cover the relevant frequency band.

The instruments shall be maintained and calibrated in accordance with the instructions of the instrument manufacturer.

- 6.2.1.2. Calibration of the entire acoustic measurement system for a measurement session

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 60942:2003. Without any further adjustment the difference between the readings of two consecutive checks shall be less than or equal to 0.5 dB(A).

If this value is exceeded, the results of the measurements obtained after the previous satisfactory check shall be discarded.

- 6.2.1.3. Compliance with requirements

Compliance of the sound calibrator with the requirements of IEC 60942:2003 and compliance of the instrumentation system with the requirements of IEC 61672-3:2013⁴ shall be confirmed by the existence of a valid certificate of compliance.

- 6.2.2. Instrumentation for other measurements

The voltage shall be measured with instrumentation having an accuracy of ± 0.05 V or better.

The resistance shall be measured with instrumentation having an accuracy of ± 0.01 Ω or better.

The distance shall be measured with instrumentation having an accuracy of ± 5 mm or better.

The time shall be measured with instrumentation having an accuracy of ± 0.02 s or better.

The meteorological instrumentation used to monitor the environmental conditions during the test shall include the following devices, which meet at least the following accuracy:

- (a) Temperature measuring device, ± 1 °C;
- (b) Wind speed-measuring device, ± 1.0 m/s;
- (c) Barometric pressure measuring device, ± 5 hPa;
- (d) A relative humidity measuring device, ± 5 per cent.

⁴ For the purpose of this Regulation, the previous versions of the standards IEC 61672-1:2004 and IEC 61672-3:2006 may be applied.

- 6.3. Measurement of the sound characteristics of the "*Non-self-adjusting audible reverse warning device*"
- 6.3.1. The audible reverse warning device should, preferably, be tested in an anechoic chamber. Alternatively, it may be tested in a semi-anechoic chamber or at a test site according to ISO 10844:2014 or in an open space.⁵ In these cases, precautions shall be taken to avoid reflections from the ground within the measuring area (for instance by erecting a set of absorbing screens). The wind speed shall be not more than 5 m/s. The "*Background noise*" level shall be at least 10 dB lower than the sound pressure level to be measured. The ambient temperature shall be between +5 °C and +40 °C inclusively.
- If the test facility shall be qualified as an anechoic environment it shall meet requirements of Annex 3.
- 6.3.2. The audible reverse warning device to be tested and the microphone shall be placed at the same height. This height shall be 1.20 m ± 0.05 m.
- In alternative, the audible reverse warning device to be tested and the microphone may be placed in another traverse line which complies with Annex 3 specification for anechoic environment.
- The microphone shall be so placed that its diaphragm is at a distance of 1.00 m ± 0.05 m from the plane of the sound outlet of the audible reverse warning device. The microphone must be positioned facing the sound emitting surface of the audible reverse warning device in the direction in which the maximum sound level can be measured. (see Figure 1 in Annex 4).
- 6.3.3. The audible reverse warning device shall be mounted rigidly, by means of the equipment indicated by the manufacturer, on a support whose mass is at least ten times that of the audible reverse warning device under test. In addition, arrangements must be made ensuring that reflections on the sides of the support and its own vibrations have no appreciable effect on the measuring results.
- 6.3.4. The audible reverse warning device shall be supplied with current, as appropriate, at the following voltages:
- 6.3.4.1. In the case of audible reverse warning device supplied with direct current, at a voltage measured at the terminal of the electric power source of 13/12 of the rated voltage with tolerance ±0.7 V;
- 6.3.4.2. In the case of audible reverse warning device supplied with alternating current, the current shall be supplied by an electric generator of the type normally used with this type of audible reverse warning device. The acoustic characteristics of the audible reverse warning device shall be recorded for an electric generator speed in the range of 75 per cent to 100 per cent of the maximum speed indicated by the manufacturer of the generator for continuous operation. During this test, no other electrical load shall be imposed on the electric generator. The endurance test described in paragraph 6.5. shall be carried out at a speed indicated by the manufacturer of the equipment and selected from the above range.
- 6.3.5. If a rectified current source is used for the test of an audible reverse warning device supplied with direct current, the alternating component of the voltage

⁵ The site may take the form, for instance, of an open space of 50 m radius which shall be free of large reflecting objects such as fences, rocks, bridges or buildings. The central part must be practically horizontal over a radius of at least 20 m. The surface, being of concrete, asphalt or a similar material, must not be moist or covered with powdery snow, tall weeds, or loose soil or cinders, as mentioned in ISO 10844:2014. No-one other than the observer reading the instrument shall remain near the audible reverse warning device or the microphone, since the presence of spectators may affect the readings of the instrument to a considerable extent, if they are near the audible reverse warning device or the microphone. Any peak which appears to be unrelated to the general sound level shall be disregarded in the reading.

- measured at its terminals, when the audible reverse warning devices are in operation, shall not be more than 0.1 V, peak to peak.
- 6.3.6. For audible reverse warning device supplied with direct current, the resistance of the connecting leads, expressed in ohms, including terminals and contacts, shall be as close as possible to $(0,10/12) \times$ rated voltage in volt.
- 6.3.7. Under the conditions set forth above, the A-weighted sound pressure level shall comply with the following for "*Non-self-adjusting audible reverse warning device*":
- equal to 62 dB(A) and less than 77 dB(A) for the signal of "*Low level*"
- equal to 77 dB(A) and not greater than 92 dB(A) for the signal of "*Normal level*"
- equal to 97 dB(A) and not greater than 112 dB(A) for the signal of "*High level*".
- The offset between the measured values of "*Low level*" and "*Normal level*" shall be at least 5 dB in the practical design of the audible reverse warning device.
- 6.3.7.1. "*Non-self-adjusting audible reverse warning device*" of Class L shall comply with the sound pressure levels described for "*Low level*" in 6.3.7.
- 6.3.7.2. "*Non-self-adjusting audible reverse warning device*" of Class N shall comply with the sound pressure levels described for "*Normal level*" in 6.3.7.
- 6.3.7.3. "*Non-self-adjusting audible reverse warning device*" of Class H shall comply with the sound pressure levels described for "*High level*" in 6.3.7.
- 6.3.7.4. "*Non-self-adjusting audible reverse warning device*" of Class I shall comply with the sound pressure levels described for "*Low level*" and "*Normal level*" in 6.3.7.
- 6.3.7.5. "*Non-self-adjusting audible reverse warning device*" of Class II shall comply with the sound pressure levels described for "*Normal level*" and "*High level*" in 6.3.7.
- 6.3.7.6. "*Non-self-adjusting audible reverse warning device*" of Class III shall comply with the sound pressure levels described for "*Low level*", "*Normal level*" and "*High level*" in 6.3.7.
- 6.3.8. The specifications indicated above shall also be met by an audible reverse warning device subjected to the endurance test referred to in paragraph 6.5. below, with the supply voltage varying between 115 per cent and 95 per cent of its rated voltage for audible reverse warning device supplied with direct current or, for audible reverse warning device supplied with alternating current, between 50 per cent and 100 per cent of the maximum speed of the generator indicated by the manufacturer for continuous operation.
- 6.3.9. The time lapse between the moment when the audible reverse warning device is actuated and the moment when the sound reaches the minimum value prescribed in paragraph 6.3.7. above shall not exceed two cycles.
- 6.3.10. To confirm the rated sound frequency (or frequency range) of audible reverse warning device the tests to measure this parameter shall be conducted with a spectrum analyser with a frequency resolution of no more than 1 Hz. The measured frequency (or frequency range) of the audible reverse warning device may differ from the rated sound frequency (or frequency range) no more than 10 per cent.
- 6.4. Measurement of the sound characteristics of the "*Self-adjusting audible reverse warning device*" and "*Stepwise self-adjusting reverse warning device*"
- 6.4.1. The audible reverse warning device should, preferably, be tested in an anechoic chamber. Alternatively, it may be tested in a semi-anechoic chamber or at a test

site according to ISO 10844:2014 or in an open space.⁶ In these cases, precautions shall be taken to avoid reflections from the ground within the measuring area (for instance by erecting a set of absorbing screens). The wind speed shall be not more than 5 m/s. The "Background noise" level shall be at least 10 dB lower than the sound pressure level to be measured. The ambient temperature shall be between +5 and +40 °C inclusively.

If the test facility shall be qualified as an anechoic environment it shall meet requirements of Annex 3.

- 6.4.2. The audible reverse warning device to be tested, the loudspeaker and the microphone shall be placed at the same height. This height shall be 1.20 m ± 0.05 m.

In alternative, the audible reverse warning device to be tested, the loudspeaker and the microphone may be placed in another traverse line which complies with Annex 3 specification for anechoic environment.

The microphone shall be so placed that its diaphragm is at a distance of 1.00 m ± 0.05 m from the plane of the sound outlet of the audible reverse warning device. The microphone must be positioned facing the front surface emitting sound of the audible reverse warning device in the direction in which the maximum sound level can be measured. The loudspeaker for reference sound is placed at a distance of 1.00 m ± 0.05 m from the audible reverse warning device and from the microphone, facing between the microphone and the audible reverse warning device, on the same height as the measurement microphone (1.20 m ± 0.05 m), see Figure 2 in Annex 4.

- 6.4.3. The audible reverse warning device shall be mounted rigidly, by means of the equipment indicated by the manufacturer, on a support whose mass is at least ten times that of the audible reverse warning device under test. In addition, arrangements must be made ensuring that reflections on the sides of the support and its own vibrations have no appreciable effect on the measuring results.

- 6.4.4. The audible reverse warning device shall be supplied with current, as appropriate, at the following voltages:

- 6.4.4.1. In the case of audible reverse warning device supplied with direct current, at a voltage measured at the terminal of the electric power source of 13/12 of the rated voltage with tolerance ±0.7 V;

- 6.4.4.2. In the case of audible reverse warning device supplied with alternating current, the current shall be supplied by an electric generator of the type normally used with this type of audible reverse warning device. The acoustic characteristics of the audible reverse warning device shall be recorded for an electric generator speed in the range of 75 per cent to 100 per cent of the maximum speed indicated by the manufacturer of the generator for continuous operation. During this test, no other electrical load shall be imposed on the electric generator. The endurance test described in paragraph 6.5. shall be carried out at a speed indicated by the manufacturer of the equipment and selected from the above range.

- 6.4.5. If a rectified current source is used for the test of an audible reverse warning device supplied with direct current, the alternating component of the voltage measured at its terminals, when the audible reverse warning devices are in operation, shall not be more than 0.1 V, peak to peak.

- 6.4.6. For audible reverse warning device supplied with direct current, the resistance of the connecting leads, expressed in ohms, including terminals and contacts, shall be as close as possible to (0,10/12) x rated voltage in volt.

- 6.4.7. A reference sound, simulating ambient noise emitted by the loudspeaker (see

⁶ See paragraph 6.31., footnote 5.

paragraph 6.4.2), equally distributed over the audible reverse warning device as well as the test microphone and measured by the test microphone (Figure 2 in Annex 4), shall emit pink noise at three different sound pressure levels. The reference sound level for:

- Reference sound level 1: 45 dB(A) \pm 2 dB(A)
- Reference sound level 2: 60 dB(A) \pm 2 dB(A)
- Reference sound level 3: 80 dB(A) \pm 2 dB(A)

Pink noise is defined as random noise, where each octave carries an equal amount of sound energy throughout the frequency range of at least 200 Hz to 8000 Hz.

6.4.8. Under the conditions set forth in paragraph 6.4.7, the sound pressure level emitted by the "*Self-adjusting audible reverse warning device*", intended for the range of 62 dB(A) to 112 dB(A), measured at the test microphone (see Figure 2 in Annex 4), shall fall within the following sound pressure level ranges:

- equal to 63 dB(A) and not greater than 74 dB(A) for reference sound level 1⁷;
- equal to 78 dB(A) and not greater than 89 dB(A) for reference sound level 2;
- equal to 98 dB(A) and not greater than 109 dB(A) for reference sound level 3.

6.4.9. Under the conditions set forth in paragraph 6.4.7., the sound pressure level emitted by the "*Stepwise self-adjusting audible reverse warning device*", measured at the test microphone (Figure 2 in Annex 4), divided into at least three separate sound level ranges and then fall inside the following sound level modes:

- equal to 62 dB(A) and less than 77 dB(A) for the signal of "Low level" for reference sound level 1
- equal to 77 dB(A) and not greater than 92 dB(A) for the signal of "Normal level" for reference sound level 2
- equal to 97 dB(A) and not greater than 112 dB(A) for the signal of "High level" for reference sound level 3

The offset between the measured values of "*Low level*" and "*Normal level*" shall be at least 5 dB in the practical design of the audible reverse warning device.

The required sound pressure level has to be achieved after a maximum of two cycles of the warning sound.

Note: Other distributions of sound level ranges are accepted as long as they follow the main principles described in paragraph 6.4.9. providing appropriate output levels for the background level range specified above.

The ambient noise (represented by the reference sound produced in the test) has to determine the appropriate output level in each situation in accordance with the following table:

⁷ The lower side is calculated based on: (Reference sound) + (inverse square law from 7 m to 1 m) + (lower side margin) – (tolerance). Example for "reference sound level 1": 45+17+5-4 dBA=63 dBA
The higher side is calculated as: Reference sound + inverse square law from 7 m to 1 m + higher side margin + tolerance. Example: 45+17+8+4 dBA=74 dBA
The other levels are calculated in the same way.

<i>Ambient noise</i>	<i>"Stepwise self-adjusting audible reverse warning device" output setting</i>	
Below 50 dB(A)	Low	The system should emit a sound complying with " <i>Low level</i> " mode
From/including 50 dB(A) to 55 dB(A)	Low	The system can emit a sound complying with " <i>Low level</i> " mode but is allowed to emit a sound complying with " <i>Normal level</i> " mode
From/including 55 dB(A) to 65 dB(A)	Normal	The system should emit a sound complying with " <i>Normal level</i> " mode
From/including 65 dB(A) to 70 dB(A)	High	The system can emit a sound complying with " <i>Normal level</i> " mode but is allowed to emit a sound complying with " <i>High level</i> " mode
Greater than/including 70 dB(A)	High	The System should emit a sound complying with " <i>High level</i> " mode

- 6.4.10. The specifications indicated above shall also be met by an audible reverse warning device subjected to the endurance test referred to in paragraph 6.5. below, with the supply voltage varying between 115 per cent and 95 per cent of its rated voltage for audible reverse warning device supplied with direct current or, for audible reverse warning device supplied with alternating current, between 50 per cent and 100 per cent of the maximum speed of the generator indicated by the manufacturer for continuous operation.
- 6.4.11. The time lapse between the moment when the audible reverse warning device is actuated and the moment when the sound reaches the minimum value prescribed in 6.4.8. above shall not exceed two cycles.
- 6.4.12. To confirm the rated sound frequency (or frequency range) of audible reverse warning device the tests to measure this parameter using a spectrum analyzer with a frequency resolution of no more than 1 Hz shall be conducted.
- The measured basic frequency (or frequency range) of the audible reverse warning device has to be within the range of 1k to 3.5k Hz. The frequency should be measured for 10 cycles and must not differ more than 10 per cent between each cycle. To measure the frequency (or frequency range) the loudspeaker for ambient noise simulation has to be switched off.
- 6.5. Endurance test
- 6.5.1. The audible reverse warning device shall be supplied with current at the rated voltage and with the connecting lead resistances specified in paragraphs 6.3.4. to 6.3.6. above.
- 6.5.2. If the test is made in an anechoic chamber, the chamber shall be large enough to ensure normal dispersal of the heat released by the audible reverse warning device during the test.
- 6.5.3. Temperature endurance tests in series to be made on one and the same device as described below:
- 6.5.3.1. put the device at 70°C in the temperature conditioning chamber (test chamber) for one hour;
- 6.5.3.2. put the device at -30°C in the test chamber for one hour;
- 6.5.3.3. put the device under operation at 50°C in the test chamber for one hour;
- 6.5.3.4. put the device under operation at -20°C in the test chamber for one hour;
- 6.5.4. Durability test

50 hours operation continuously at $25^{\circ}\text{C} \pm 11^{\circ}\text{C}$

6.5.5. Vibration endurance test

Cycles: 2000 cycles per minute $\pm 10\%$

Amplitude: 2 mm $\pm 10\%$

Directions: x, y, z three directions for each 30 minutes

Temperature: $25^{\circ}\text{C} \pm 11^{\circ}\text{C}$.

6.5.6. Put the device under operation at $25^{\circ}\text{C} \pm 11^{\circ}\text{C}$ after the complete procedure in accordance with paragraphs 6.5.3. to 6.5.5. and check the acoustic performance in accordance with 6.3. and 6.4.

6.6. Resistance against dust and water

IP54 protection in accordance with IEC60529 shall be provided.

7. Modification and extension of approval of the type of the audible reverse warning device

7.1. Every modification of the type of the audible reverse warning device shall be notified to the Type Approval Authority which granted approval to that type of the audible reverse warning device. This Type Approval Authority may then:

7.1.1. Either take the view that the modifications made are not likely to have any appreciable adverse effect

7.1.2. or call for a new report from the Technical Service responsible for the tests.

7.2. Communication on confirmation of the approval, with particulars of the modifications, or of refusal of approval shall be communicated to the Parties to the Agreement applying this Regulation, in accordance with the procedure indicated in paragraph 5.3. above.

7.3. The Type Approval Authority issuing the extension of approval shall assign a series number to each communication form drawn up for such an extension.

8. Conformity of production

The conformity of production procedures shall comply with those set out in the 1958 Agreement, Schedule 1 (E/ECE/TRANS/505/Rev.3) with the following requirements:

8.1. Audible reverse warning device approved under this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set forth in paragraph 6. above.

8.2. The authority which has granted type approval may at any time verify the conformity control methods applied in each production facility. The normal frequency of these verifications shall be once every two years.

9. Penalties for non-conformity of production

9.1. The approval granted to a type of audible reverse warning device pursuant to this Regulation may be withdrawn if the conditions set forth in paragraph 8.1. are not complied with or if the audible reverse warning device fails to pass the checks referred to in paragraph 8.2. above.

9.2. Should a Party to the Agreement applying this Regulation withdraw an approval which it has previously granted, it shall forthwith notify the other

Contracting Parties applying this Regulation by means of a copy of the approval form bearing at the end in large letters the statement, signed and dated: "APPROVAL WITHDRAWN".

10. Production definitively discontinued

If the holder of an approval granted pursuant to this Regulation discontinues the production of the type of audible reverse warning device approved, he shall inform the authority which granted the approval. Upon receipt of the communication, this authority shall inform the other Parties to the Agreement applying this Regulation by means of a copy of the approval form bearing at the end in large letters the statement, signed and dated: "PRODUCTION DISCONTINUED".

II. Part II. Audible reverse warning signals for motor vehicles

11. Definitions relevant for Part II

For the purpose of this Regulation,

- 11.1. "Approval of the motor vehicle" shall be understood to mean approval of a vehicle type with regard to its audible reverse warning signal;
- 11.2. "Vehicle type" means a category of motor vehicles, which does not differ essentially in such respect as:
 - 11.2.1. The shape and the materials of the bodywork of the vehicle which affect the sound level emitted;
 - 11.2.2. If applicable, the number and type(s) (for example identification number of the device or the type approval number) of the reverse audible warning device(s) fitted on the vehicle and their general position.
 - 11.2.3. A vehicle type in respect of this Regulation can also include vehicles from different vehicle classes (e.g. vehicles of category N₂ and N₃ within the same vehicle approval) if the vehicles are not essentially different in respect of their rearward acoustic behaviour.
- 11.3. "Pause function" means a mechanism to halt temporarily the operation of a reverse warning device.

12. Application for approval

- 12.1. The application for approval of a vehicle type with regard to its audible reverse warning signals shall be submitted by the vehicle manufacturer or by his duly accredited representative.
- 12.2. It shall be accompanied by a duly filled technical information document, either in paper format in triplicate or alternatively upon agreement with the Type Approval Authority in electronic format. A model of the technical information document is shown in Annex 1B.
- 12.3. If applicable, a list of the components of non-component-type-approved audible reverse warning device(s)
- 12.4. If applicable, a drawing of the assembled non-component-type-approved audible reverse warning device(s) and an indication of its position on the vehicle.
- 12.5. A vehicle representative of the vehicle type to be approved shall be submitted

to the technical service responsible for the approval tests.

- 12.6. The Type Approval Authority shall verify the existence of satisfactory arrangements for ensuring effective control of the conformity of production before type approval is granted

13. Approval

- 13.1. If the vehicle type submitted for approval pursuant to this Regulation meets the requirements of paragraph 14. below, approval for this vehicle type shall be granted.
- 13.2. An approval number shall be assigned to each type approved. Its first two digits (at present 00 for the UN Regulation in its original form) shall indicate the series of amendments incorporating the most recent major technical amendments made to the UN Regulation at the time of issue of the approval. The same Contracting Party may not assign this number to another vehicle type.
- 13.3. Communication on approval or extension or withdrawal of approval or 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 1B to the UN Regulation.
- 13.4. On every vehicle which conforms to a vehicle type approved under this Regulation there shall be affixed conspicuously, in an easily accessible place indicated on the approval form, an international approval mark comprising:
- 13.4.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which has granted approval⁸;
- 13.4.2. The number of this Regulation, followed by the letter "R", a dash and the approval number placed to the right of the circle prescribed in paragraph 13.4.1.
- 13.4.3. An additional symbol in the form of a figure in letter or Roman numerals, showing the class(es) of pursuant to paragraph 2.5. and 2.6.
- 13.5. 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 13.4.2. need not be repeated; in such a case the UN Regulation and approval numbers and the additional symbols of all the UN 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 13.4.
- 13.6. The approval mark must be clearly legible and indelible.
- 13.7. The approval mark shall be placed near the plate bearing the characteristics of the vehicle and may also be affixed to this plate.
- 13.8. Annex 2, Section III. and Section IV. to this Regulation give examples of the arrangement of the approval mark.
- 13.9. The Type Approval Authority or its duly accredited technical service shall verify the arrangements of the marks for ensuring effective control of the conformity of production before type approval is granted.

⁸ The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev. 6, Annex 3 - <https://unece.org/transport/standards/transport/vehicle-regulations-wp29/resolutions>.

14. Specifications

14.1. General specifications

14.1.1. The "Audible reverse warning device" shall emit an acoustic signal, automatically activated, when reverse gear is selected and the propulsion system is on.

14.1.2. The audible reverse warning device shall be so designed, constructed, and assembled as to enable the vehicle, despite the vibration to which it may be subjected, to comply with the provisions of this Regulation.

14.1.3. The audible reverse warning device(s) and its (their) mounting elements to the vehicle shall be so designed, constructed and assembled as to be able to reasonably resist the corrosive phenomena to which it is exposed with regards to the conditions of use of the vehicle, including regional climate differences.

14.1.4. In case a device has more than one mode, the reverse warning device shall be automatically activated to its default mode when the vehicle is restarted following each vehicle turn-off.

For "Non-self-adjusting audible reverse warning device", "Multiple audible reverse warning system", and for "Stepwise self-adjusting audible reverse warning device" the default mode is the "Normal level".

14.1.5. The manufacturer may define alternative sounds which can be selected by the driver; each of these sounds shall be "Tonal sound" (paragraph 2.7.1.) or "Broadband sound" (paragraph 2.7.2.) or "On-third octave band sound" (paragraph 2.7.3.) and in compliance with the provisions in paragraphs 14.2.2.1., 14.2.2.2. or 14.2.2.3.

14.2. Specifications regarding sound levels

14.2.1. Each sound made by the audible reverse warning device(s) fitted to the vehicle type submitted for approval shall be measured by the methods described in paragraph 14.4. or 14.5.

14.2.2. Measured under the relevant specifications (test site etc.) and conditions specified in paragraphs 14.4. and 14.5. the sound pressure level of the signal tested shall fulfil limit value(s) described in paragraph 14.2.2.1., 14.2.2.2. or 14.2.2.3.

14.2.2.1. "Non-self-adjusting audible reverse warning device" or "Multiple audible reverse warning system"

"Non-self-adjusting audible reverse warning device" or "Multiple audible reverse warning system" shall emit sound:

- equal to 45 dB(A) and less than 60 dB (A) for the signal of "Low level"
- equal to 60 dB(A) and not greater than 75 dB (A) for the signal of "Normal level"
- equal to 80 dB(A) and not greater than 95 dB (A) for the signal of "High level".

The offset between the measured values of "Low level" and "Normal level" shall be at least 5 dB in the practical design of the audible reverse warning device.

14.2.2.2. "Self-adjusting audible reverse warning device"

The sound pressure level, measured in accordance with 14.5, shall comply with the requirements below:

Minimum +5 dB and maximum +8 dB in addition to the "Ambient noise" according with paragraph 14.5.6. – in the range of at least 45 dB(A) to 95 dB(A).

14.2.2.3. "Stepwise self-adjusting audible reverse warning device"

The sound pressure level, measured in accordance with 14.5, shall comply with the requirements below:

- equal to 45 dB(A) and less than 60 dB(A) for the signal of "*Low level*"
- equal to 60 dB(A) and not greater than 75 dB(A) for the signal of "*Normal level*"
- equal to 80 dB(A) and not greater than 95 dB(A) for the signal of "*High level*"

The offset between the measured values of "*Low level*" and "*Normal level*" shall be at least 5 dB in the practical design of the audible reverse warning device.

The vehicle verification test shall at least cover one of the prescribed levels under condition that the device has been proven to comply with the requirements described in Part I in this document.

14.2.3. The values measured in accordance with the provisions of paragraph 14.4. and 14.5. shall be entered in the test report and a communication corresponding to the model shown in Annex 1B.

14.3. Pause function

The manufacturer may install a pause function to disable temporarily the audible reverse warning device when a vehicle of category M₂ (M>3500 kg), N₂, M₃ or N₃ is equipped with a non-audible safety system, device(s) for means of rear visibility or detection as described in UN Regulation No. 158, paragraph 1.3, allowing the driver to check the hazard area behind the vehicle, including when towing vehicle(s) of category O, and it is ensured that such safety system(s) functions while reversing. Any other disabling function which does not satisfy the specifications below is prohibited.

14.3.1. When the towed vehicle(s) of category O is(are) not equipped with a device for means of rear visibility or detection as described in UN Regulation No. 158, paragraph 1.3. which is valid for vehicles of category O, the activation of the pause function shall be disabled at the vehicle of category M₂ (M>3500 kg), N₂, M₃ or N₃ (the audible reverse warning device shall still be active).

14.3.2. The pause function shall be located so that it is operable by the driver in a normal seating position.

14.3.3. In the case when the pause function is activated, the suspension of reverse warning sound has to be indicated clearly to the driver.

14.3.4. The pause switch shall be deactivated when the vehicle is re-started following each vehicle turn-off.

14.3.5. Owner's manual information

If a pause function is installed, the manufacturer shall provide the owner with information (e.g. in the owner's manual) as to the increased risks thus created:

The pause function of the audible reverse warning device shall not be used unless for an obvious lack of necessity to emit sound for warning vulnerable road users in the surrounding area.

14.4. Measurement on a stationary vehicle of the sound characteristics of the "*Non-self-adjusting audible reverse warning device*" and "*Multiple audible reverse warning system*".

14.4.1. The vehicle shall comply with the following specifications:

- 14.4.1.1. Endurance test
- Either
- The audible reverse warning device(s) fitted on the vehicle has been of a type approved under this Part I of this Regulation
- or
- The audible reverse warning device(s) fitted on the vehicle, which has not been of a type approved under Part I of this Regulation, has (have) to fulfil the "Endurance test" of paragraph 6.5. except 6.5.6. and 6.6. of this Regulation. After this test the audible reverse warning device(s) shall pass the test according to Part II of this regulation.
- 14.4.1.2. Location of the audible reverse warning device(s) when fitted on the vehicle
- In the case where the device(s) has (have) not been of a type approved under Part I of this Regulation
- the device(s) shall be fitted on the area of the rear overhung (the area from the rearmost axle to the rear end)
- and
- where the rearmost axle is not located in the last quarter of the overall length of the vehicle, the device(s) has (have) to be mounted in the last quarter of the total length of the vehicle from the rear.
- 14.4.1.3. The test voltage shall be as specified in paragraph 6.3.4. to 6.3.6. of this Regulation.
- In case of audible reverse warning device(s) supplied with direct current, the test voltage shall be supplied by either:
- (a) The vehicle battery only
- or
- (b) The vehicle battery with the vehicle engine warmed-up and at idle or
 - (c) With an external power source supply connected to the audible reverse warning device(s).
- 14.4.2. The sound pressure level and other measurements shall be made with instruments complying with the specification in paragraph 6.2. of this Regulation.
- 14.4.3. The A-weighted sound pressure level emitted by the audible reverse warning device(s) fitted on the vehicle shall be measured at a distance of 7.00 m \pm 0.10 m to the rear of the vehicle at CC-line (see Figure 1 in Annex 5), which is being placed on an open site⁹, on flat concrete or asphalt surface, or in an indoor test facility meeting the requirements of Annex 3.
- 14.4.4. The microphone of the measuring instrument shall be placed approximately (\pm 0.10 m) in the mean longitudinal plane of the vehicle.
- 14.4.5. Background noise correction procedure
- 14.4.5.1. Measurement criteria for A-weighted sound pressure level
- The "*Background noise*" shall be measured for a duration of at least 10 seconds. A 10 second sample taken from these measurements shall be used to calculate the reported background noise, ensuring the 10 seconds sample selected is representative of the background noise in the absence of any transient disturbance. The measurements shall be made with the same

⁹ See paragraph 6.3.1., footnote 5.

microphone and microphone location used during the test.

When testing in an indoor facility meeting the requirements of Annex 3, the noise emitted by other test facility equipment, inclusive of the noise caused by air handling of the facility, shall be reported as the background noise.

The recorded maximum A-weighted sound pressure level from the measurement microphone during the 10 second sample shall be reported as the background noise, L_{bgn} .

For each 10 second sample, the maximum to minimum range of the background noise, $\Delta L_{bgn, p-p}$, shall be reported.

As an aid for measurement and reporting of background noises see flowchart in Figure 1 of Annex 6.

14.4.5.2. Audible reverse warning signals of motor vehicle A-weighted sound pressure level measurement correction criteria

Depending on the level and the range of maximum to minimum value of the representative background noise A-weighted sound pressure level over a defined time period, the measured test result within a test condition, L_{test} , shall be corrected according to the table below to obtain the background noise corrected level $L_{test\ corr}$. Except where noted $L_{test\ corr} = L_{test} - L_{corr}$ in the table below.

Background noise corrections to measurements are only valid when the range of the maximum to minimum background noise A-weighted sound pressure levels are 4 dB(A) or less.

<i>Correction for "Background noise"</i>		
<i>Range of maximum to minimum value of the representative "Background noise" A-weighted sound pressure level over a defined time period $\Delta L_{bgn, p-p}$ in dB(A)</i>	<i>Sound pressure level of test result minus "Background noise" level $\Delta L = L_{test} - L_{bgn}$ in dB(A)</i>	<i>Correction in dB(A) L_{corr}</i>
-	$\Delta L \geq 10$	no correction needed
≤ 4	$8 \leq \Delta L < 10$	0,5
	$6 \leq \Delta L < 8$	1,0
	$4.5 \leq \Delta L < 6$	1,5
	$3 \leq \Delta L < 4.5$	2,5
	$\Delta L < 3$	no valid measurement can be reported

If a sound peak obviously out of character with the general sound pressure level is observed, that measurement shall be discarded.

As an aid for measurement correction criteria see flowchart in Figure 2 of Annex 6.

14.4.6. The maximum sound pressure level shall be sought within the range of 0.5 and 1.5 m above the ground, and the height, at which the maximum sound-pressure level was found has to be fixed for the purpose of taking the measurements prescribed below.

The sound pressure level shall be measured at that fixed height for a duration of at least 10 seconds. The final result shall be the maximum A-weighted sound pressure level of the reading period, rounded mathematically to the nearest integer.

In all cases where the range of the maximum to minimum background noise is greater than 4 dB(A), the maximum level of the background noise shall be 10

dB(A) or greater below the level of the measurement. When the maximum to minimum range of background noise is greater than 4 dB(A) and the level of the background noise is less than 10 dB(A) below the measurement, no valid measurement is possible.

- 14.5. Measurement on stationary vehicle of the sound characteristics of the "*Stepwise self-adjusting audible reverse warning device*" or the "*Self-adjusting audible reverse warning device*"
- 14.5.1. The vehicle shall comply with the following specifications:
- 14.5.1.1. Endurance test
- Either
- The audible reverse warning device(s) fitted on the vehicle has been of a type approved under this Part I of this Regulation;
- or
- The audible reverse warning device(s) fitted on the vehicle, which has not been of a type approved under Part I of this Regulation, has (have) to fulfil the "Endurance test" of paragraph 6.5. except 6.5.6. and 6.6. of this Regulation. After this test the audible reverse warning device(s) shall pass the test according to Part II of this regulation.
- 14.5.1.2. Location of the audible reverse warning device(s) when fitted on the vehicle
- In the case where the device(s) has (have) not been of a type approved under Part I of this Regulation
- the device(s) shall be fitted on the area of the rear overhung (the area from the rearmost axle to the rear end)
- and
- where the rearmost axle is not located in the last quarter of the overall length of the vehicle, the device(s) has (have) to be mounted in the last quarter of the total length of the vehicle from the rear.
- 14.5.1.3. The test voltage shall be as specified in paragraph 6.3.4. to 6.3.6. of this Regulation.
- In case of audible reverse warning device(s) supplied with direct current, the test voltage shall be supplied by either:
- (a) The vehicle battery only;
- or
- (b) The vehicle battery with the vehicle engine warmed-up and at idle; or
 - (c) With an external power source supply connected to the audible reverse warning device(s).
- 14.5.2. The sound pressure level and other measurements shall be made with instruments complying with the specifications in paragraph 6.2. of this Regulation.
- 14.5.3. The A-weighted sound pressure level emitted by the audible reverse warning device(s) fitted on the vehicle shall be measured at a distance of 7.00 m \pm 0.10 m to the rear of the vehicle at CC-line (see Figure 2 in Annex 5), which is being placed on a test site according to ISO 10844:2014 or an open site¹⁰, on flat concrete or asphalt surface, or in an indoor test facility meeting the requirements of Annex 3.

¹⁰ See paragraph 6.3.1., footnote 5.

14.5.4. The microphone of the measuring instrument shall be placed $7.00\text{ m} \pm 0.10\text{ m}$ in the mean longitudinal plane of the vehicle (along CC-line).

14.5.5. Background noise correction procedure

14.5.5.1. Measurement criteria for A-weighted sound pressure level

The "*Background noise*" shall be measured for a duration of at least 10 seconds. A 10 second sample taken from these measurements shall be used to calculate the reported background noise, ensuring the 10 seconds sample selected is representative of the background noise in the absence of any transient disturbance. The measurements shall be made with the same microphone and microphone location used during the test with the test object and all other test equipment turned off, not needed for the background noise recording.

When testing in an indoor facility meeting the requirements of Annex 3, the noise emitted by other test facility equipment, inclusive of the noise caused by air handling of the facility, shall be reported as the background noise.

The recorded maximum A-weighted sound pressure level from the measurement microphone during the 10 second sample shall be reported as the background noise, L_{bgn} .

For each 10 second sample at the microphone, the maximum to minimum range of the background noise, $\Delta L_{bgn, p-p}$, shall be reported.

As an aid for measurement and reporting of background noises see flowchart in Figure 1 of Appendix 6.

14.5.5.2. Vehicle A-weighted sound pressure level measurement correction criteria in case of measuring the performance of "*Stepwise self-adjusting audible reverse warning device*":

Depending on the level and the range of maximum to minimum value of the representative background noise A-weighted sound pressure level over a defined time period, the measured test result within a test condition, L_{test} , shall be corrected according to the table below to obtain the background noise corrected level $L_{test\ corr}$. Except where noted, $L_{test\ corr} = L_{test} - L_{corr}$ in the table below. Background noise corrections to measurements are only valid when the range of the maximum to minimum background noise A-weighted sound pressure levels are 4 dB(A) or less.

In all cases where the range of the maximum to minimum background noise A-weighted sound pressure level is greater than 4 dB(A), the maximum level of the background noise shall be 10 dB(A) or greater below the level of the measurement. When the maximum to minimum range of background noise is greater than 4 dB(A) and the level of the background noise is less than 10 dB(A) below the measurement, no valid measurement is possible.

Correction for "Background noise"		
Range of maximum to minimum value of the representative "Background noise" A-weighted sound pressure level over a defined time period $\Delta L_{bgn, p-p}$ in dB(A)	Sound pressure level of test result minus "Background noise" level $\Delta L = L_{test} - L_{bgn}$ in dB(A)	Correction in dB(A) L_{corr}
-	$\Delta L \geq 10$	no correction needed
≤ 4	$8 \leq \Delta L < 10$	0,5
	$6 \leq \Delta L < 8$	1,0
	$4.5 \leq \Delta L < 6$	1,5
	$3 \leq \Delta L < 4.5$	2,5
	$\Delta L < 3$	no valid measurement can be reported

If a sound peak obviously out of character with the general sound pressure level is observed, that measurement shall be discarded.

As an aid for measurement correction criteria see flowchart in Figure 2 of Annex 6.

14.5.5.3. Background noise in case of measuring the performance of "Self-adjusting audible reverse warning device"

If a sound peak obviously out of character with the general sound pressure level is observed, that measurement shall be discarded.

14.5.6. Specific specification concerning "Self-adjusting audible reverse warning device"

This paragraph specifies how the "Self-adjusting audible reverse warning device" shall be checked when mounted in vehicle with respect to its emitted sound level.

If the device has not been proven to comply with the requirements described in Part I in this Regulation, the basic function of this device and its ability to adjust the output to the instant "Ambient noise" shall be verified in accordance with Part I of this Regulation.

The A-weighted sound pressure level shall be determined at test measurement positions described in paragraph 14.5.3.

A reference sound shall be used to trigger the self-adjustment function. The arrangement for the purpose of emitting reference sound can be either

- the running engine of the vehicle with the device mounted, but switched off,
- or a secondary sound source, positioned in a similar set-up with loudspeaker as in paragraph 6.4.2. in Part I of this document; this sound source, e.g. the centre of the loudspeaker diaphragm, shall be placed at the height of $1.20 \text{ m} \pm 0.05 \text{ m}$ and at equidistance of $7.00 \text{ m} \pm 0.10 \text{ m}$ from the rear of the vehicle as well as the measurement microphone (see Figure 2 in Annex 5);
- or the reference level of the test can also be achieved by the (site) background level, recorded in accordance with paragraph 14.5.5.

The maximum sound pressure level shall be sought within the range of 0.5 and 1.5 m above the ground, and the height at which the maximum sound pressure level was found has to be fixed for the purpose of taking the measurements prescribed below, similar to paragraph 14.4.6.

The sound pressure level shall be measured at that fixed height for a duration of at least 10 seconds.

Capture the maximum sound pressure level with the audible reverse warning device off (device off).

Capture the maximum sound pressure level with the audible reverse warning device on (device on).

The recorded values from the "device on" shall be at least +5 dB and maximum +8 dB in addition to the measured value from the "device off". The value, including a tolerance of ± 4 dB, shall fall inside the range of at least 45 dB(A) to 95 dB(A) in accordance with paragraph 14.2.2.2.

The final result shall be the maximum A-weighted sound pressure levels of the reading period, rounded mathematically to the nearest integer.

To be reported: measurement levels for "device on" and "device off".

14.5.7. Specific specification concerning "*Stepwise self-adjusting reverse warning device*" This paragraph specifies how the "*Stepwise self-adjusting reverse warning device*" shall be checked when mounted in vehicle with respect to its emitted sound level.

If the device has not been proven to comply with the requirements described in Part I in this Regulation, the basic function of this device and its ability to adjust the output to the instant "*Ambient noise*" shall be verified in accordance with Part I of this Regulation.

The A-weighted sound pressure level shall be determined at test measurement positions in paragraph 14.5.3.

The arrangement for the purpose of emitting "*Reference sound*" can be either

- the running engine of the vehicle with the device mounted, but switched off;
- or a secondary sound source, similar to the set-up with loudspeaker in paragraph 6.4.2. in Part I of this document; however, the in case of a loudspeaker emitting the reference sound, the centre of this loudspeaker diaphragm shall be placed at the height of $1.20 \text{ m} \pm 0.05 \text{ m}$ and at an equidistance of $7.00 \text{ m} \pm 0.10 \text{ m}$ from the rear of the vehicle as well as the measurement microphone (see Figure 2 in Annex 5);
- or the reference level of the test can also be achieved by the (site) background level, recorded in accordance with paragraph 14.5.5.

The maximum sound pressure level shall be sought within the range of 0.5 m and 1.5 m above the ground, and the height at which the maximum sound pressure level was found has to be fixed for the purpose of taking the measurements prescribed below, similar to paragraph 14.4.6.

The sound pressure level shall be measured at that fixed height for a duration of at least 10 seconds.

Capture the maximum sound pressure level with the audible reverse warning device off (device off).

Capture the maximum sound pressure level with the audible reverse warning device on (device on).

The recorded values from "device on" shall be a minimum of +5 dB in addition to the measured value from the "device off" and comply with the requirements below:

- equal to 45 dB(A) and less than 60 dB(A) for the signal of "*Low level*"

- equal to 60 dB(A) and not greater than 75 dB(A) for the signal of "Normal level"
- equal to 80 dB(A) and not greater than 95 dB(A) for the signal of "High level"

The value, including a tolerance of ± 4 dB, shall fall inside the corresponding range above.

The final results shall be the maximum A-weighted sound pressure level of the reading period, rounded mathematically to the nearest integer.

To be reported: measurement levels for "device on" and "device off".

14.6. General

At the time of application of this Regulation, Contracting Parties shall declare which Classes of the "Non-self-adjusting audible reverse warning device" (N, I, II, III) and / or the "Multiple audible reverse warning system" (M-I, M-II, M-III) of this Regulation they intend to mandate in their territory for each category of vehicles if the vehicles in questions are not equipped with either a "Self-adjusting audible reverse warning device" or a "Stepwise self-adjusting audible reverse warning device".¹¹

15. Modification and extension of approval of the vehicle type

- 15.1. Every modification of the vehicle type shall be notified to the Type Approval Authority which granted approval to the vehicle type. This Type Approval Authority may then:
- 15.1.1. Either take the view that the modifications made are not likely to have any appreciable adverse effect and that in any case the vehicle still meets the requirements; or
- 15.1.2. Call for a new report from the Technical Service responsible for the tests.
- 15.2. Communication on confirmation of approval with particulars of the modifications, or of refusal of approval shall be communicated to the Parties to the Agreement applying this Regulation, in accordance with the procedure indicated in paragraph 13.3. above.
- 15.3. The Type Approval Authority issuing the extension of approval shall assign a series number to each communication form drawn up for such an extension.

16. Conformity of production

The conformity of production procedures shall comply with those set out in the 1958 Agreement, Schedule 1 (ECE/TRANS/505/Rev.3) with the following requirements:

- 16.1. A vehicle approved under this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set forth in paragraph 14. above.
- 16.2. The Type Approval Authority which has granted type approval may at any time verify the conformity control methods applied in each production facility. The normal frequency of these verifications shall be once every two years.

¹¹ Devices of class L or H shall only be used in combination with devices of other classes which includes "Normal level".

17. Penalties for non-conformity of production

- 17.1. The approval granted to a vehicle type pursuant to this Regulation may be withdrawn if the conditions set forth in paragraph 16.1. above are not complied with, or if the vehicle fails to pass the checks referred to in paragraph 16.2. above.
- 17.2. Should a Party to the Agreement applying this Regulation withdraw an approval which it has previously granted, it shall forthwith notify the other Contracting Parties applying this Regulation by means of a copy of the approval from bearing at the end in large letters the statement, signed and dated: "APPROVAL WITHDRAWN".

18. Production definitively discontinued

- 18.1. 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 1B to this Regulation.

19. Names and addresses of Technical Services responsible for conducting approval tests and of Type Approval Authorities

The Contracting 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 Type Approval Authorities 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.

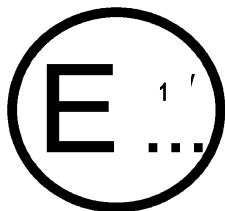
Annex 1A

Communication for type approval of audible reverse warning devices

(maximum format: A4 (210 x 297 mm))

issued by:

Name of administration:



.....
.....
.....

Concerning:² Approval granted
Approval extended
Approval refused
Approval withdrawn
Production definitively discontinued

of a type of audible reverse warning devices:²

"Non-self-adjusting audible reverse warning device",

"Self-adjusting audible reverse warning device",

"Stepwise self-adjusting audible reverse warning device"

for motor vehicles pursuant to UN Regulation No. 165

Approval No.:³

Extension No.: ...

Section I

- 0.1. Make (trade name (mark) of manufacturer):
- 0.2. Type or commercial description:
- 0.3. Means of identification of type if marked:⁴
 - 0.3.1. Location of that marking:
- 0.4. Name and address of manufacturer:
- 0.5. Name and address of the manufacturer's representative (if any):
- 0.6. Names and address(es) of assembly plant(s):

Section II

1. Additional information (where applicable): See Addendum
2. Technical service responsible for carrying out the tests:

¹ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulation). The proportions and dimensions in accordance with Annex 3.

² Delete (strike out) what does not apply.

³ Approval No and Extension No. The first two digits of the approval number indicate that UN Regulation No. 165 was in its original form. (See example of marking in Annex 2.)

⁴ If the means of identification of type contains characters not relevant to describe the type warning devices covered by the type-approval certificate such characters shall be represented in the documentation by the symbol: '?' (e.g. ABC??123??).

3. Date of test report:
4. Number of test report:
5. Remarks (if any): See Addendum
6. Place:
7. Date:
8. Signature:
9. Reasons for Extensions:

Attachments:

Information package

Test report(s)

Addendum to the communication form No. ...,⁵ Extension No.: ...

1. Additional information:
 - 1.1. Brief description of a principle of operation:
 - 1.2. Rated voltage(s), V:
 - 1.3. Rated sound frequency (or frequencies), Hz:
2. Test results for each of two samples:
 - 2.1.
For "Tonal sound" A-weighted sound pressure level
For "Broadband sound" A-weighted sound pressure level
For "One-third octave band sound" A-weighted sound pressure level
 - 2.4. Endurance test: passed / not passed²
3. Remarks

⁵ Approval No and Extension No.: The first two digits of the approval number indicate that UN Regulation No. 165 was in its original form.

Annex 1A – Appendix 1

Technical Information Document for type approval of audible reverse warning devices – "*Non-self-adjusting audible reverse warning device*", "*Self-adjusting audible reverse warning device*" and "*Stepwise self-adjusting audible reverse warning device*" – for motor vehicles

0. General
 - 0.1. Make (trade name (mark) of manufacturer):
 - 0.2. Type or commercial description:
 - 0.3. Means of identification of type if marked:
 - 0.3.1. Location of that marking:
 - 0.4. Principles of operation: Fixed arrangements / Variable arrangements due background noise:¹
 - 0.5. Name and address of manufacturer:
 - 0.6. Name and address of the manufacturer's representative (if any):
 - 0.7. Names and address(es) of assembly plant(s):
 1. General construction characteristics
 - 1.1. Brief description of a principle of operation
 - 1.2. Rated voltage(s), V:¹
 - 1.3. Rated sound frequency (or frequencies), Hz:¹
 - 1.6. Photographs and/or drawings
 - 1.7. Drawings showing the place provided for the approval number in relation to the circle of the approval mark; the location and the appearance of trade name or mark of the manufacturer and type or commercial description (if any):
 - 1.8. A list of the components used in production, duly identified, with an indication of the materials used;
 - 1.9. Drawings in cross section and of all the components used in production.
- Signed:
- Position in company:
- Date:

¹ Delete (strike out) what does not apply.

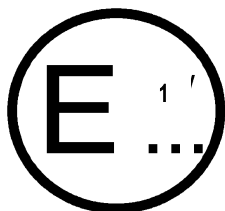
Annex 1B

Communication for type approval of a vehicle with regard to its audible reverse warning signals

(maximum format: A4 (210 x 297 mm))

issued by:

Name of administration:



.....
.....
.....

concerning:² Approval granted
Approval extended
Approval refused
Approval withdrawn
Production definitively discontinued

of a vehicle type with regard to its audible reverse warning signals pursuant to UN Regulation No. 165

Approval No.:³

Extension No.:

Section I

- 0.1. Make (trade name of manufacturer of vehicle):
- 0.2. Type:
- 0.3. Means of identification of type if marked on the vehicle:⁴
 - 0.3.1. Location of that marking:
- 0.4. Category of vehicle:⁵
- 0.5. Name and address of manufacturer:
- 0.6. Names and address(es) of assembly plant(s):
- 0.7. Name and address of the manufacturer's representative (if any):

Section II

1. Additional information (where applicable): See Addendum
2. Technical service responsible for carrying out the tests:
3. Date of test report:
4. Number of test report:

¹ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulation). The proportions and dimensions in accordance with Annex 2.

² Delete (strike out) what does not apply.

³ Approval No and Extension No. The first two digits of the approval number indicate that Regulation No. 165 was in its original form.

⁴ If the means of identification of type contains characters not relevant to describe the vehicle types covered by the type-approval certificate such characters shall be represented in the documentation by the symbol: '?' (e.g. ABC??123??).

⁵ As defined in R.E.3.

5. Remarks (if any): See Addendum
6. Place:
7. Date:
8. Signature:
9. Reasons for Extensions:

Attachments:

- Information package
- Test report(s)

Addendum to the communication form No. ...,³ Extension No.: ...

1. Additional information
 - 1.1. Make (trade name (mark) of manufacturer) of audible reverse warning device(s):
 - 1.2. Type or commercial description of audible reverse warning device(s):
 - 1.3. Means of identification of type if marked on the audible reverse warning device(s):⁶
 - 1.4. The approval number and issuing authority of audible reverse warning device(s):
2. Test results
 - 2.1. Power supply used: Vehicle battery only / Battery with vehicle engine at idle / External power supply²
 - 2.2. *"Non-self-adjusting audible reverse warning device"* or *"Multiple audible reverse warning system"*⁷,
For "Tonal sound" A-weighted sound pressure level⁷
For "Broadband sound" A-weighted sound pressure level⁷
For "One-third octave band sound" A-weighted sound pressure level⁷
"Low level": A-weighted sound pressure level: dB(A)⁷
"Normal level": A-weighted sound pressure level: dB(A)⁷
"High level": A-weighted sound pressure level: dB(A)⁷
 - 2.3. *"Self-adjusting audible reverse warning device"*⁷
*for "Tonal sound"*⁷
*for "Broadband sound"*⁷
*for "One-third octave band sound"*⁷
A-weighted sound pressure level: dB(A) above reference/ambient sound⁷ between dB(A) and dB(A)

⁶ If the means of identification of type contains characters not relevant to describe the type of audible reverse warning device(s) covered by the type-approval certificate, such characters shall be represented in the documentation by the symbol: '?' (e.g. ABC??123??).

⁷ Delete (strike out) what does not apply

- 2.4. "*Stepwise self-adjusting audible reverse warning device*"
 for "*Tonal sound*"⁷
 for "*Broadband sound*"⁷for "*One-third octave band sound*"⁷
 A-weighted sound pressure level: dB(A) above reference/ambient
 sound⁷ between dB(A) and dB(A)
 Time to switch sound level mode: sec above reference/ambient sound⁷
 sound between dB(A) and dB(A)
3. Remarks

Annex 1B – Appendix 1

Technical Information Document for type approval of a vehicle with regard to its audible reverse warning signals

0. General
- 0.1. Make (trade name of manufacturer of vehicle):
- 0.2. Type:
- 0.3. Means of identification of type if marked on the vehicle¹:
 - 0.3.1. Location of that marking:
- 0.4. Category of vehicle:²
- 0.5. Name and address of manufacturer:
- 0.6. Name and address of the manufacturer's representative (if any):
- 0.7. Name(s) and Address(es) of assembly plant(s):
- 0.8. Make (trade name (mark) of manufacturer) of audible reverse warning device(s):
- 0.9. Type or commercial description of audible reverse warning device(s):
- 0.10. Means of identification of type marked on the audible reverse warning device(s):³
- 0.11. The approval number and issuing authority of audible reverse warning device(s):⁴
- 0.12. Rated voltage(s), V:⁴
1. General construction characteristics of the mountings of the audible reverse warning device(s) on the vehicle
 - 1.1. Photographs or drawings of a representative vehicle:
 - 1.2. Drawings of the mountings and mounting position(s) of the audible reverse warning device(s):
 - 1.3. Description of the component materials in front of the audible reverse warning device(s):
 - 1.4. A list of the components used in production on which the audible reverse warning device(s) are fitted, duly identified, with indication of the materials used;
 - 1.5. Detailed drawings of all the components on which the device(s) are fitted, used in production;
Signed:
Position in company:
Date:

¹ If the means of identification of type contains characters not relevant to describe the vehicle types covered by the type-approval certificate such characters shall be represented in the documentation by the symbol: '?' (e.g. ABC??123??).

² As defined in R.E.3.

³ If the means of identification of type contains characters not relevant to describe the type of the audible reverse warning devices covered by the type-approval certificate such characters shall be represented in the documentation by the symbol: '?' (e.g. ABC??123??).

⁴ Delete (strike out) what does not apply.

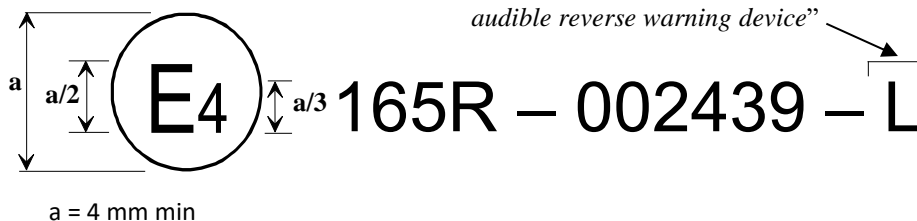
Annex 2

Arrangement of the approval mark

I. Arrangement of the approval mark of the "Non-self-adjusting audible reverse warning device"

(see paragraph 5.5. of this Regulation)

Class (Table 1): Letter or Roman numerals for Basic designation for "Non-self-adjusting audible reverse warning device"



The above approval mark affixed to an audible reverse warning device of Class L shows that this audible reverse warning device has been approved in the Netherlands (E 4) under approval number 002439. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of UN Regulation No. 165 in its original form.

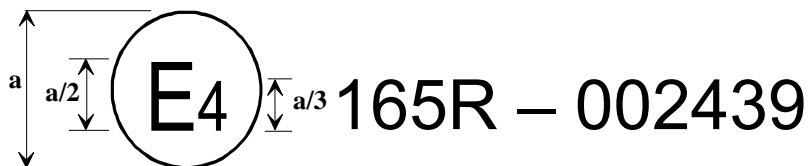
Notes: The approval number must be placed close to the circle and must be in a position either above or below the letter "E" or to left or right of that letter. The digits of the approval number must be on the same side of the letter "E" and face in the same direction. The use of Roman numerals as approval numbers should be avoided so as to prevent any confusion with other symbols.

Table 1
Characters with reference to the approved "Non-self-adjusting audible reverse warning device" (see paragraph 2.5. of this Regulation)

Class	"Non-self-adjusting audible reverse warning device"
Class L	able to emit sound levels of "Low level" only
Class N	able to emit sound levels of "Normal level" only
Class H	able to emit sound levels of "High level" only
Class I	able to emit sound levels of "Low level" and "Normal level"
Class II	able to emit sound levels of "Normal level" and "High level"
Class III	able to emit sound levels of "Low level", "Normal level" and "High level"

II. Arrangement of the approval mark of the "Self-adjusting audible reverse warning device" and "Stepwise self-adjusting audible reverse warning device"

(see paragraph 5.5. of this Regulation)



$a = 4 \text{ mm min}$

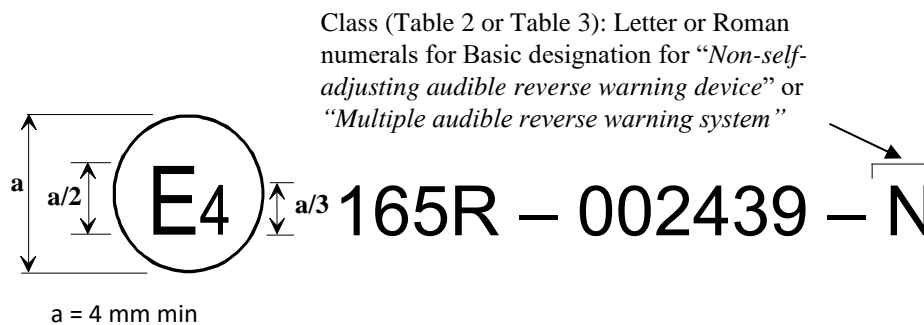
The above approval mark affixed to an audible reverse warning device shows that this audible reverse warning device has been approved in the Netherlands (E 4) under approval number 002439. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of UN Regulation No. 165 in its original form.

Notes: The approval number must be placed close to the circle and must be in a position either above or below the letter "E" or to left or right of that letter. The digits of the approval number must be on the same side of the letter "E" and face in the same direction. The use of Roman numerals as approval numbers should be avoided so as to prevent any confusion with other symbols.

III. Arrangement of the approval mark of vehicle, with regard to its audible reverse warning signals emitted by "Non-self-adjusting audible reverse warning device" or "Multiple audible reverse warning system"

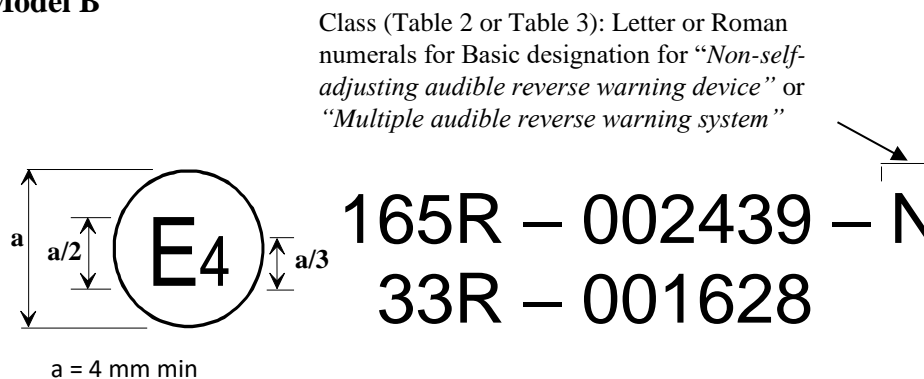
(see paragraph 13.8. of this Regulation)

Model A



The above approval mark affixed to a vehicle indicates that, pursuant of UN Regulation No. 165, this vehicle type has device(s) of Class N and has been approved in the Netherlands (E 4), with regard to its audible warning signals. The first two digits of the approval number indicate that UN Regulation No. 165 was in its original form.

Model B



The above approval mark affixed to a vehicle shows that the vehicle type has device(s) of Class N and has been approved in the Netherlands (E 4) pursuant of UN Regulations No. 165 and 33.¹ The approval numbers indicate that, at the dates when the respective approvals were granted, UN Regulation No. 165 and UN Regulation No. 33 were in their original form.

Table 2

Characters with reference to the approved "Non-self-adjusting audible reverse warning device" (see paragraph 2.5. of this Regulation)

Class	"Non-self-adjusting audible reverse warning device"
Class N	able to emit sound levels of "Normal level" only
Class I	able to emit sound levels of "Low level" and "Normal level"

¹ The latter number is given as an example only.

Class II	able to emit sound levels of " <i>Normal level</i> " and " <i>High level</i> "
Class III	able to emit sound levels of " <i>Low level</i> ", " <i>Normal level</i> " and " <i>High level</i> "

Table 3

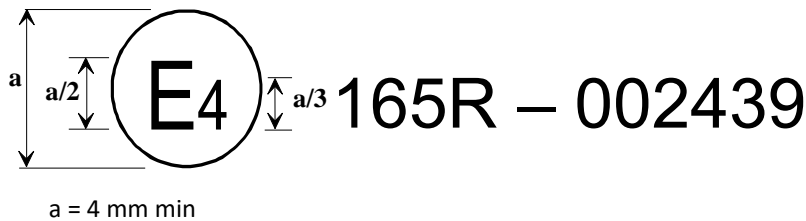
Characters with reference to the approved "*Multiple audible reverse warning system*"
(see paragraph 2.6. of this Regulation)

<i>Class</i>	<i>"Multiple audible reverse warning system"</i>
Class M-I	able to emit sound levels of " <i>Low level</i> " and " <i>Normal level</i> "
Class M-II	able to emit sound levels of " <i>Normal level</i> " and " <i>High level</i> "
Class M-III	able to emit sound levels of " <i>Low level</i> ", " <i>Normal level</i> " and " <i>High level</i> "

IV. Arrangement of the approval mark of vehicle, with regard to its audible reverse warning signals emitted by "Self-adjusting audible reverse warning device" or "Stepwise self-adjusting audible reverse warning device"

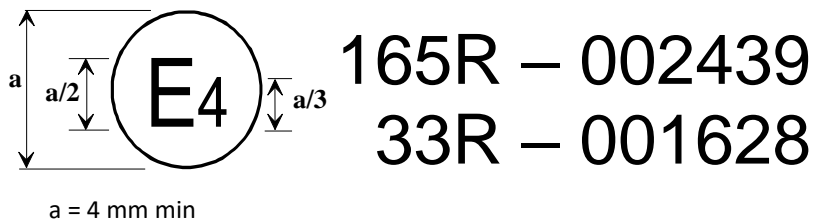
(see paragraph 13.8. of this Regulation)

Model A



The above approval mark affixed to a vehicle indicates that, to UN Regulation No. 165, this vehicle type has been approved in the Netherlands (E 4), with regard to its audible warning signals. The first two digits of the approval number indicate that UN Regulation No. 165 was in its original form.

Model B



The above approval mark affixed to a vehicle shows that the vehicle type has been approved in the Netherlands (E 4) pursuant to UN Regulations Nos. 165 and 33.² The approval numbers indicate that, at the dates when the respective approvals were granted, UN Regulation No. 165 and UN Regulation No. 33 were in their original form.

² The latter number is given as an example only.

Annex 3

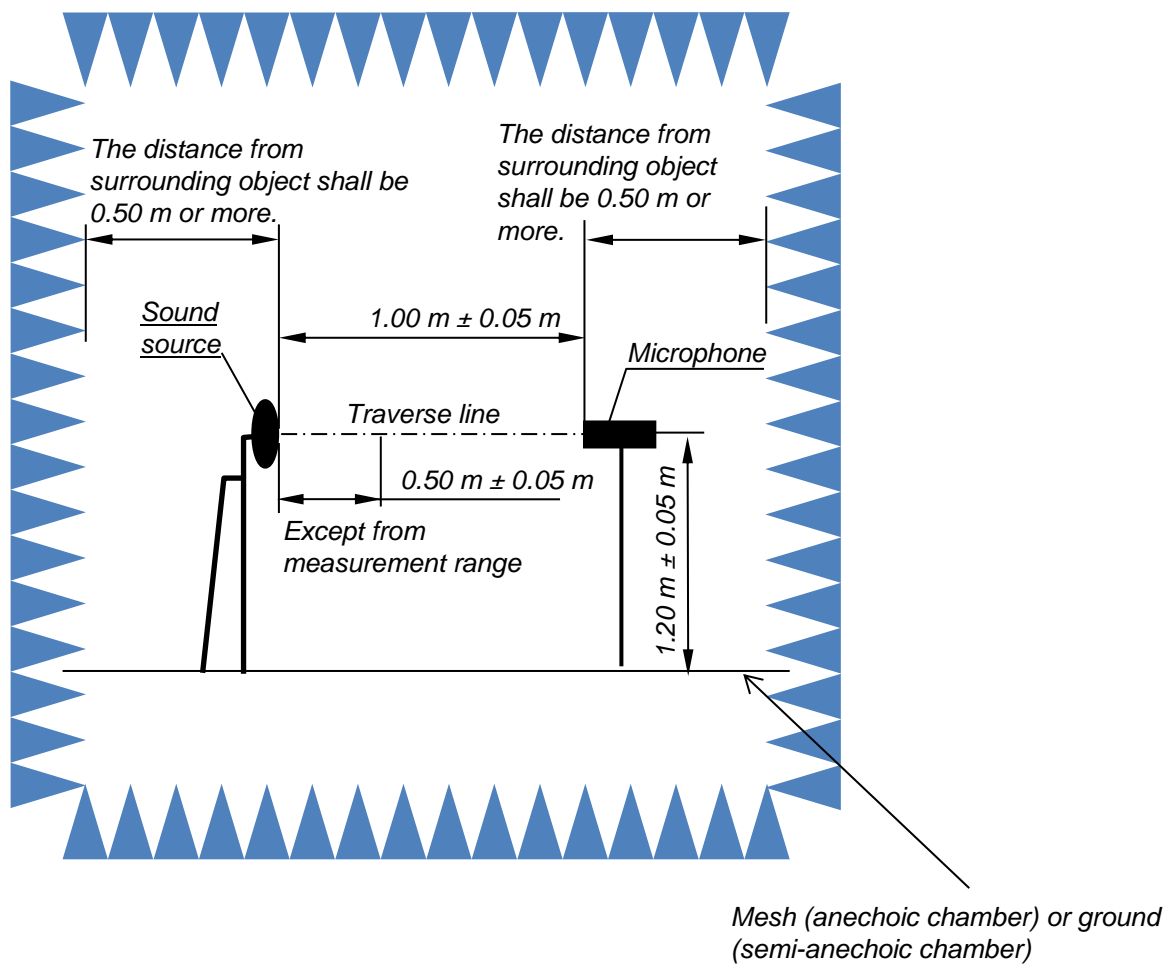
Qualification criteria for anechoic environment

The anechoic environment shall meet the requirements of ISO 26101:2012 with the following qualification criteria and measurement requirements appropriate to this test method. For qualifying the acoustic space, the following evaluation shall be conducted:

- Sound source location shall be placed on the floor in middle of the space deemed to be anechoic;
- Sound source shall provide a broadband input for measurement;
- Evaluation shall be conducted in one-third octave bands in the bands of interest;
- Microphone locations for evaluation shall be on a line from the source location to position of the microphone used for measurement. This is commonly referred to as the microphone traverse; only one microphone traverse line from the microphone to sound source shall be used;
- A minimum of 4 points shall be used for evaluation on the microphone traverse line. The measurement shall start at $0.5 \text{ m} \pm 0.05 \text{ m}$ from the sound source, and spacing shall be 0.15 m (e.g. Figure 1);
- The test facility shall have a cut-off frequency, as defined in ISO 26101:2012, lower than the lowest frequency of interest. The lowest frequency of interest is the one-third-octave band below which there is no signal content relevant to the measurement of sound emission for the audible reverse warning device under test.
- The highest frequency of interest is the one-third-octave band above which there is no signal content relevant to the measurement of sound emission for the audible reverse warning device under test.
- The deviations of the measured sound pressure levels from those estimated using the inverse square law, shall not exceed the values given in the following table.

<i>One-third octave-band frequency (Hz)</i>	<i>Allowable deviations (dB)</i>
≤ 630	± 1.5
800 to 5000	± 1.0
≥ 6300	± 1.5

Figure 1



Annex 4

Microphone positions for measurements of acoustics parameters of audible reverse warning device

Figure 1

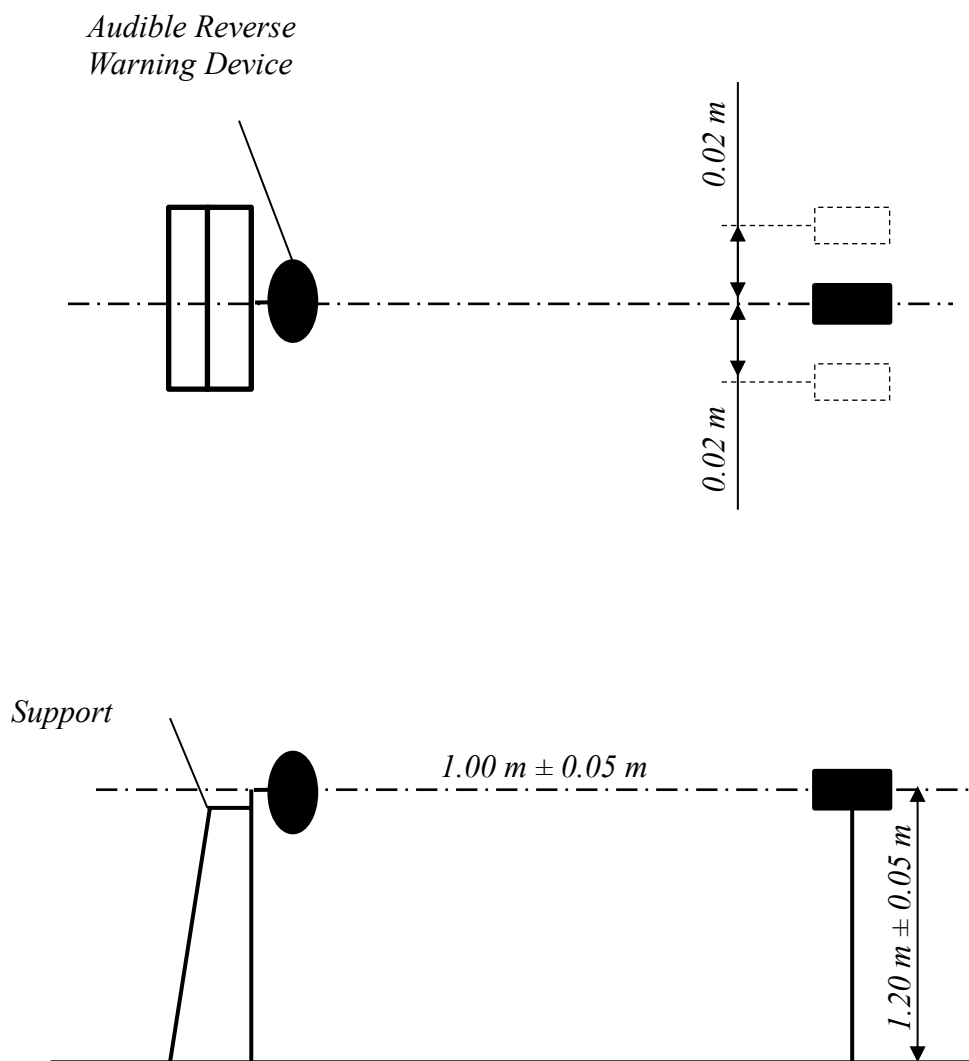
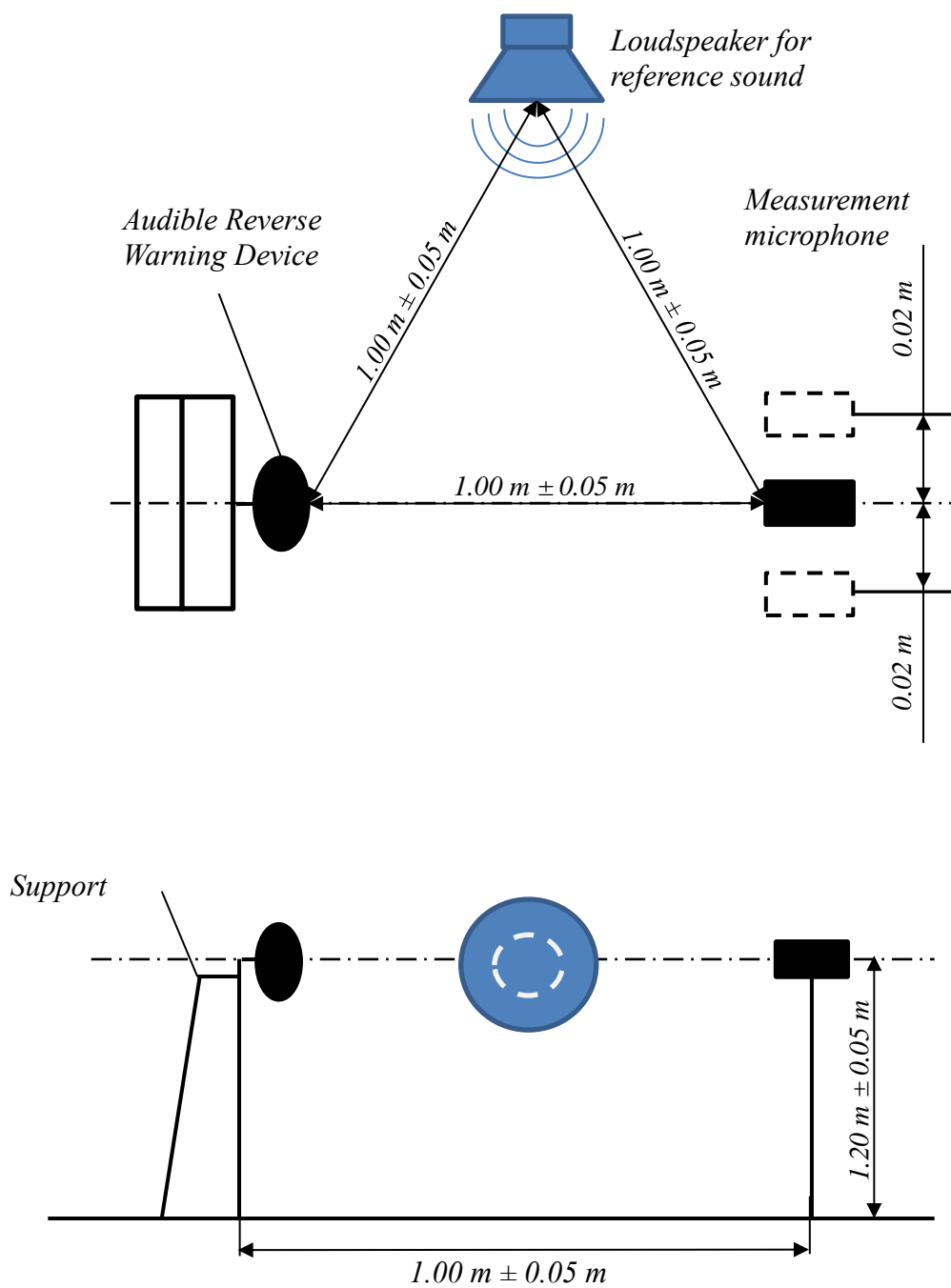


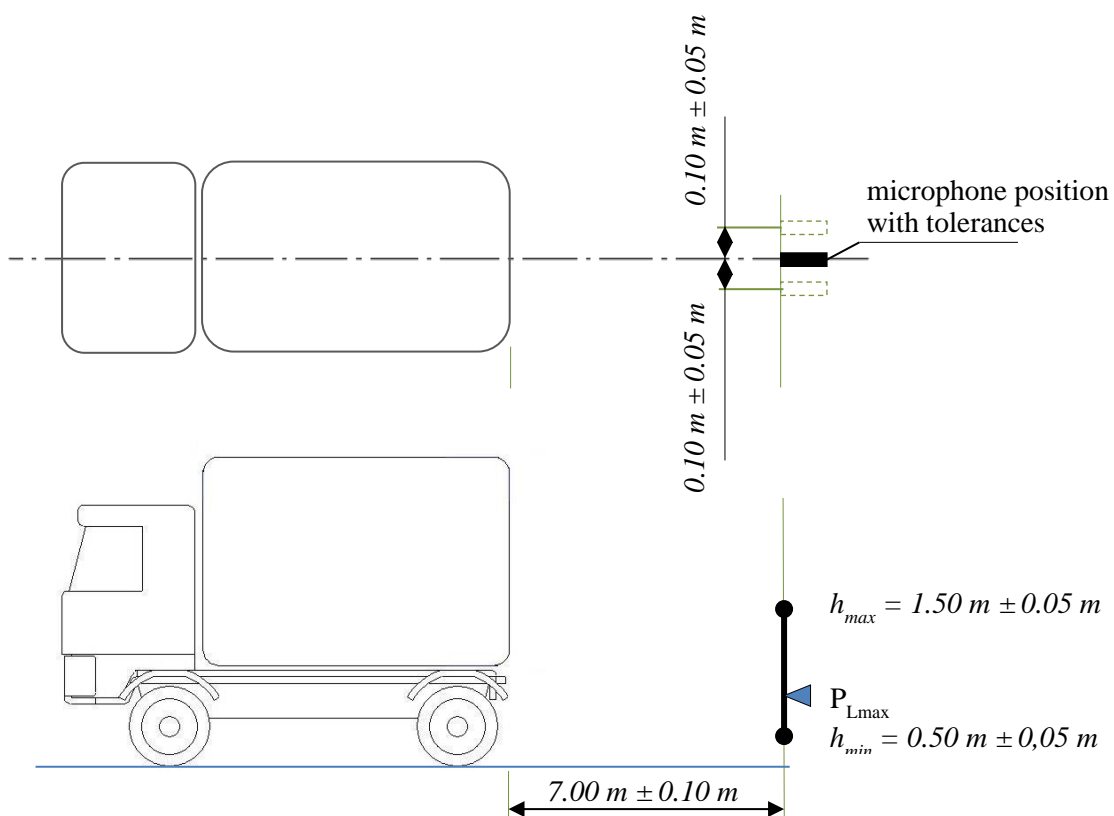
Figure 2



Annex 5

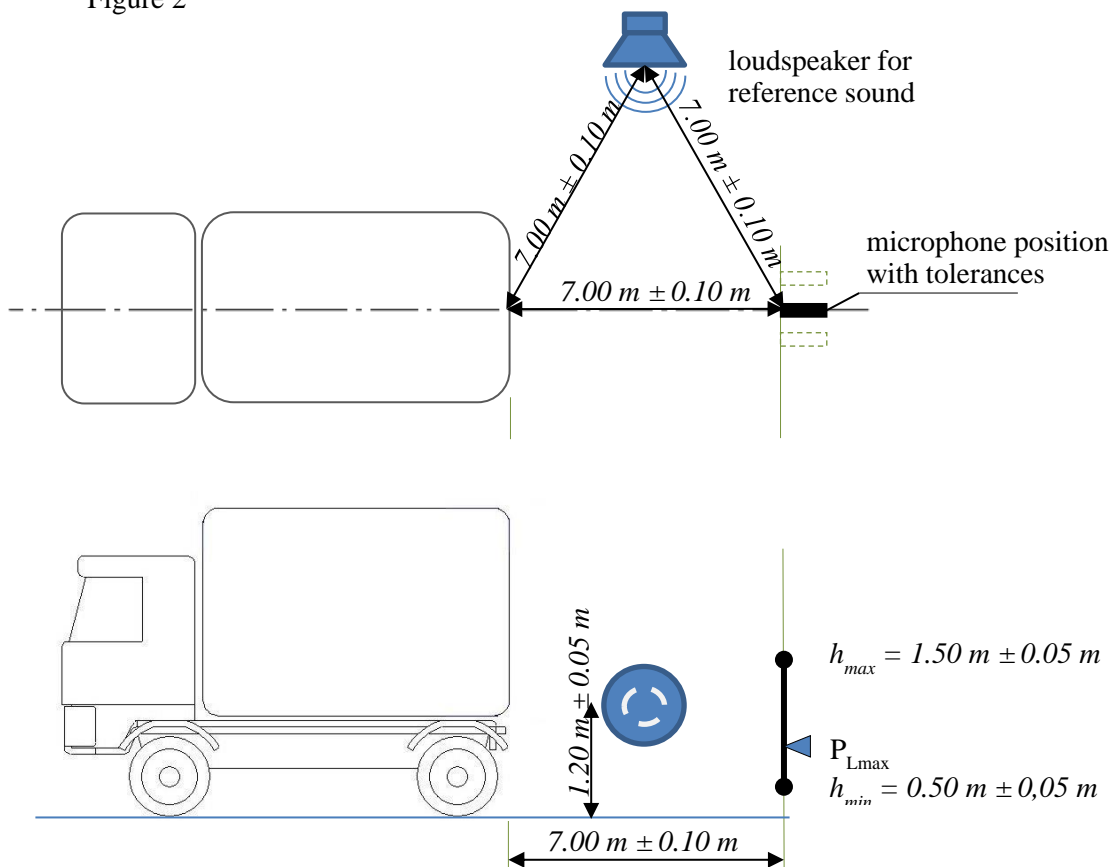
Microphone position for measurements of audible reverse warning signals of motor vehicles

Figure 1



h_{min} : minimum height for measurements
 h_{max} : maximum height for measurements
 P_{Lmax} : point of maximum sound pressure level

Figure 2



h_{min} : minimum height for measurements
 h_{max} : maximum height for measurements
 P_{Lmax} : point of maximum sound pressure level

Annex 6

Flowcharts

Figure 1
Determination of the range of "Background noise" (14.4.5.) (14.5.5.)

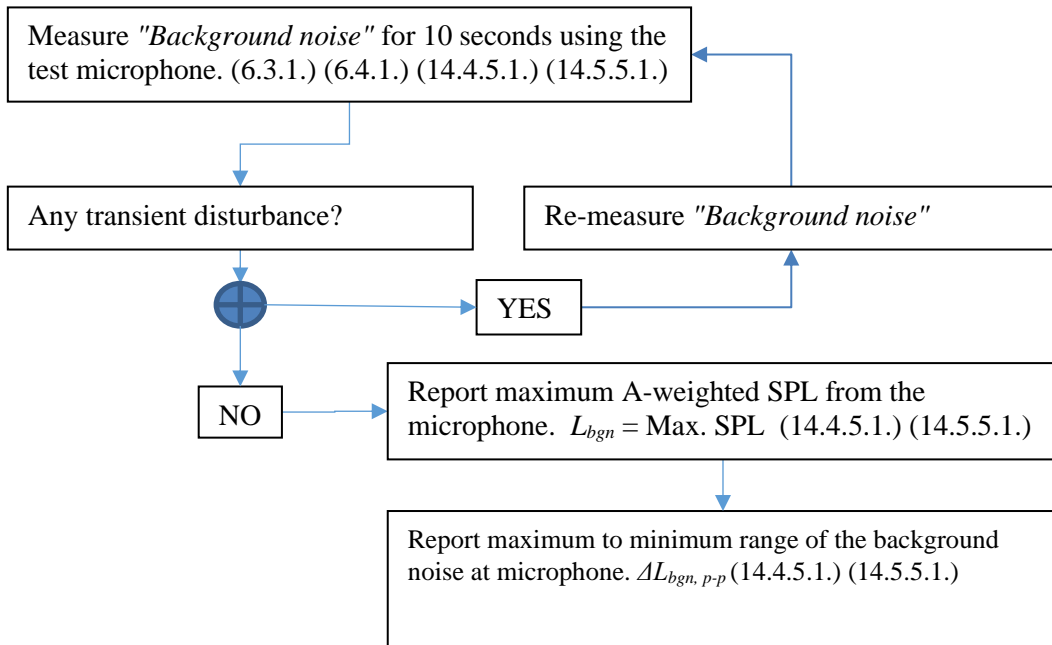


Figure 2
Vehicle A-weighted sound pressure level measurement correction criteria

