

# Status report to GRBP #74

## Task Force on Reverse Warning Sound issues

# Meeting

18th meeting : 17 March, 2021 Web meeting

19th meeting : 19 April, 2021 Web meeting

20th meeting : 27 May, 2021 Web meeting

21st meeting : 11 June, 2021 Web meeting

22nd meeting : 14 June, 2021 Web meeting

23rd meeting : 21 June, 2021 Web meeting

24th meeting : 2 July, 2021 Web meeting

25th meeting : 7 July, 2020 Web meeting

26th meeting : 14 July, 2021 Web meeting

27th meeting : 20 August, 2021 Web meeting

28th meeting : 2 September, 2021 Web meeting

# Participants

Contracting parties : China, EC, Germany, Japan, Netherlands, UK

NGOs, etc : OICA, CLEPA, Reversing warning sound device manufactures (Guest)

# Schedule of document submission to GRBP

- In status report to GRBP #73, I explained we will submit working document to GRBP #74.
- 6 meetings were held to achieve the goal, but we postponed our schedule because many editorial issues were left in the draft.
- After the deadline of working document, 5 meetings were held and drafting was completed through the meetings.
- The draft was submitted to GRBP #74 as informal document.
- If there is any feedback, we will discuss it and submit a revised draft as a working document to the next GRBP.

# Results of discussion

## Composition of the draft

- The draft consists of 2 parts.
  - I. Part I. Audible reverse warning device
  - II. Part II. Audible reverse warning signals of motor vehicles

## Scope

- 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;
- 1.1.2. 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.

# Results of discussion

Changed from  
previous status report

## Definition : Device type

“*Multiple audible reverse warning system*” has been newly added to allow combination of the devices

2.1.1. “*Non-self-adjusting audible reverse warning device*” means a device which gives an 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 1 of 3 fixed sound level modes (low, normal, high), 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 device*” capable of functioning independently when applying “*Low level*”, “*Normal level*”, “*High level*”;

# Results of discussion

Changed from  
previous status report

## Mandatory sound level mode

14.6. was newly added to allow each CP to decide which sound level modes are mandatory, and class was defined for devices.

### 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*” (I, II, 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*”.

# Results of discussion

Changed from  
previous status report

## Definition : Class

Classes are defined as follows.

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

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.

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 I: The “*Multiple audible reverse warning system*” is able to emit sound levels of “*Low level*” and “*Normal level*”.

2.6.2. Class II: The “*Multiple audible reverse warning system*” is able to emit sound levels of “*Normal level*” and “*High level*”.

2.6.3. Class III: The “*Multiple audible reverse warning system*” is able to emit sound levels of “*Low level*”, “*Normal level*” and “*High level*”.



# Results of discussion

Changed from  
previous status report

## Definition : Sound level

To be more specific about when and where each sound level should be used, definition of each sound levels are defined as follows. Editorial corrections have been made to make it clear.

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<sup>2</sup>.

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).

<sup>2</sup> 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. 9

# Results of discussion

No change from  
previous status report

## Definition : Sound type

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 basically pure sound 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 with has its main energy and nearly constant power spectral density in 1 of 6 one-third octave frequency bands (Center frequency: 800, 1000, 1250, 1600, 2000, 2500 Hz or 3150 Hz).

Reverse warning sounds that do not fulfill above definition shall be excluded (i.e. Human voice message).

# Results of discussion

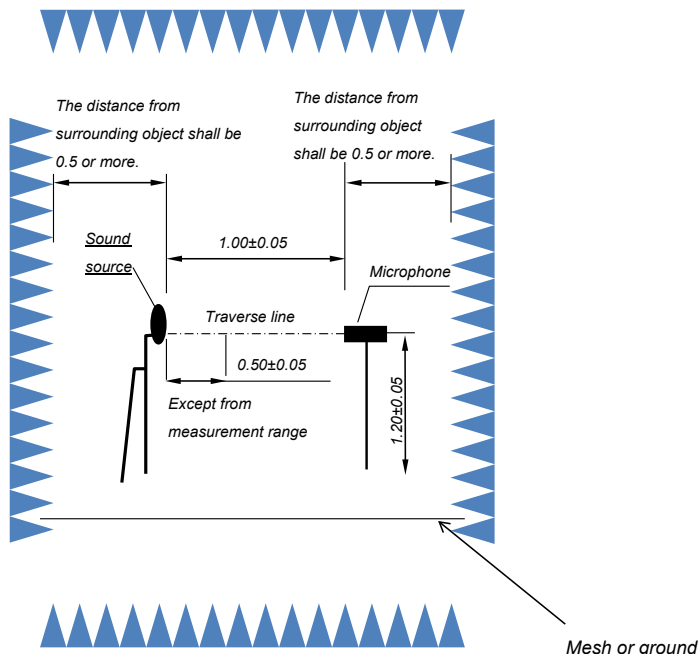
Changed from  
previous status report

## Test method : Part I (Non-self-adjusting)

Non-self-adjusting device is tested at 1m distance and 1.2m height.

Limit values of “*Low level*” have been changed in accordance with changes in limit values in part II.

Since the upper limit of “*Low level*” and the lower limit of “*Normal level*” are adjacent to each other, the difference between the measured value of “*Low level*” and the measured value of “*Normal level*” is specified to be 5 dB or more.



(All dimensions are in m)

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*” or “*Multiple audible reverse warning systems*”:

- 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.

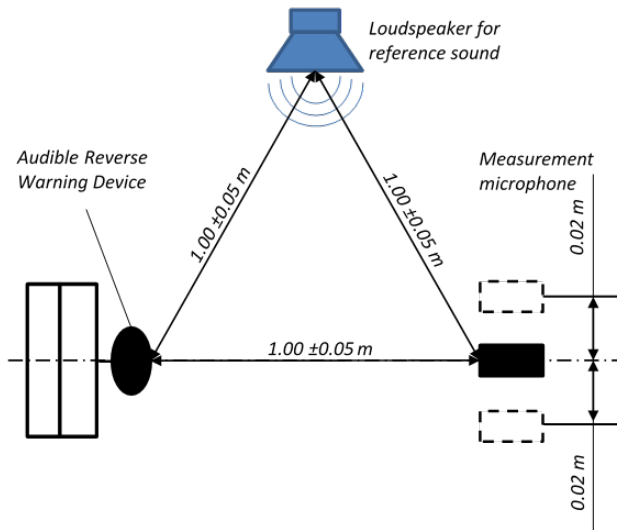
# Results of discussion

Changed from  
previous status report

## Test method : Part I (Self-adjusting & Stepwise self-adjusting)

Pink noise is emitted from loudspeaker. The device is checked whether the warning sound SPL changes according to SPL of pink noise.

SPL from the device are checked under 3 reference sound levels.



6.4.7. A reference sound, simulating ambient noise emitted by the loudspeaker, equally distributed over the audible reverse warning device as well as the test microphone and measured by the test microphone (Figure 1), has to emit pink noise at three different sound pressure levels. The reference sound loudspeaker shall be at the same height as the device and the measurement microphone. The reference sound for:

- Reference sound level 1:  $45 \pm 2$  dB(A)
- Reference sound level 2:  $60 \pm 2$  dB(A)
- Reference sound level 3:  $80 \pm 2$  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”, for the range of 62 dB(A) to 112 dB(A), measured at the test microphone (Figure 1), shall fall within the following sound pressure level ranges for:

- equal to  $63^*$  dB(A) and not greater than 74 dB(A) for reference sound level 1
- 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

\*The lower side is calculated based on: (Reference sound) + (inverse square law from 7 m to 1 m) + (lower side margin) – (tolerance).

# Results of discussion

Changed from  
previous status report

## Endurance test      Either

In some cases (i.e. garbage trucks), it is not possible to install RWS device to the rear end of the vehicle. The limit values of part II are SPL at 7m position from the rear edge of the vehicle, and limit values of part I are SPL at 1m distance which is calculated from limit value of part II according to inverse-square law.

Therefore, in case it is not possible to install the device at the rear edge of the vehicle, it can be difficult to fulfill part I and part II at the same time.

As a relief measure for such cases, 14.5.1.1 is newly added.

All device has to fulfill the “*Endurance test*”.

### 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.

# Results of discussion

Changed from  
previous status report

## Location of the audible reverse warning device(s) when fitted on the vehicle

If the installation position is unlimited, it may produce excessive SPL and cause complaints. Therefore, installation position is limited in the case the device does not fulfill the limit values of part I test.

### 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.

# Results of discussion

Changed from  
previous states report

## Endurance test

We have decided to allow the use of devices that do not fulfill the limit values of part I test, if they fulfill part II (vehicle limits).

Eliminating part I approval process completely could lead bad quality devices to be in the market. Therefore, we decided to request all devices to fulfill endurance test. In addition, the content of endurance test has been added.

### 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°C±11°C

6.5.5. **Vibration endurance test**

Cycles: 2000 ±10% cycles per minute

Amplitude: 2 mm ±10%

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

Temperature: 25°C±11°C.

6.5.6. Put the device under operation at 25°C±11°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.

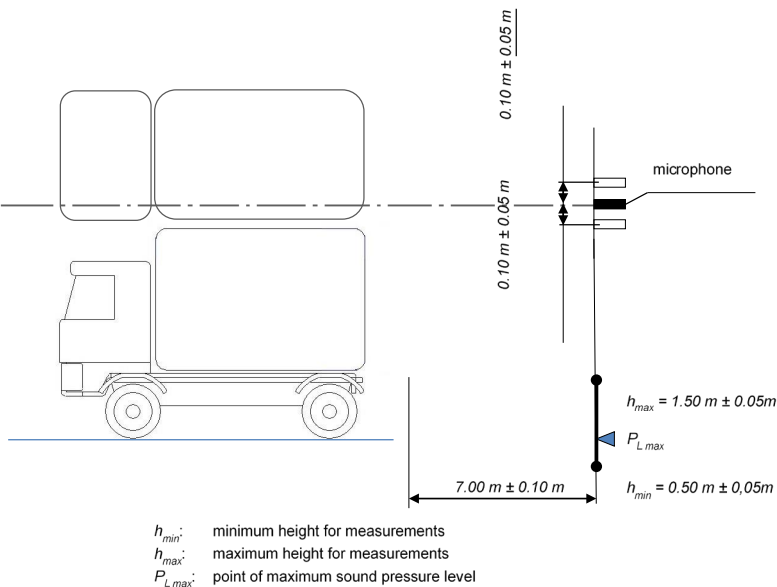
# Results of discussion

Changed from  
previous status report

## Test method : Part II (Non-self-adjusting)

Test method remains unchanged from previous status report. SPL is measured at 7m distance from rear edge of a vehicle and find  $L_{MAX}$  between 0.5m to 1.5m height.

Participants of the TFRWS expressed concern that the lower limit of the low level was too small. As a result of discussion, limit values were changed as follows.



14.2.2.1. “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 5dB in the practical design of the audible reverse warning device.



# Results of discussion

Changed from  
previous status report

## Test method : Part II (Self-adjusting & Stepwise self-adjusting)

Self-adjusting device and stepwise self-adjusting device are tested under one of following environments (Engine running/loud speaker/achieved background level).

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. The basic function of this device and its ability to adjust the output to the instant ambient sound shall be verified.

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 trig 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 1 of this document; this sound source, e.g. loudspeaker, shall be placed at equidistance of  $7.00 \pm 0.10$  m from the rear of the vehicle as well as the measurement microphone;
- or the reference level of the test can also be achieved by the (site) background level, recorded in accordance with paragraph 14.5.5.

# Results of discussion

Changed from  
previous status report

## Test method : Part II (Self-adjusting & Stepwise self-adjusting)

Maximum SPL shall be reported when the device is on and off.

The limit values for each device types are as follows.

### 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 5dB 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.

# Results of discussion

Changed from  
previous status report

## Pause function

Editorial corrections were made due to changes in VRU-Proxi IWG.

### 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**, 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 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).

# Results of discussion

## Background noise correction

A correction table in UN-R138 has been used in the draft.

This table can be used to correct the measured value when the difference between Max. and Min. of background noise ( $L_{bgn, p-p}$ ) is less than 2dB.

However, in many places where background noise correction is required,  $L_{bgn, p-p}$  is rarely less than 2dB. 4dB is more realistic.

ISO is currently considering a revision of background noise correction method.

We will reconsider based on the result.

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
$\leq 4$	$8 \leq \Delta L < 10$	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

## Next step

### Open issue

Nothing.

If there is any feedback from GRBP, TFRWS will discuss how to respond.

### Meeting

29th meeting : 19, October, 2021 Web meeting

----> If necessary

Any information or comment is welcomed.  
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