

Proposal for Amendment 2 to the Consolidated Resolution on the Construction of Vehicles

The text reproduced below was prepared by the expert from the Russian Federation for updating the UN Consolidated Resolution on the Construction of Vehicles (UN R.E.3) (document ECE/TRANS/WP.29/78/Rev.2). This text is extracted from the document ECE/TRANS/WP.29/GRB/2012/12 following the decision of the 56th GRB session (ECE/TRANS/WP.29/GRB/54, para. 28).

The proposal concerns modification of the method of measuring vehicle internal noise. The modifications to the current text of the UN R.E.3. are shown in bold characters for new or strikethrough for deleted characters.

I. Proposal

Paragraph 8.38.1.1., amend to read:

"8.38.1.1. **The apparatus used for measuring the internal noise must be a precision sound-level meter or equivalent measurement system meeting the requirements of class 1 instruments (including the recommended windscreen, if used). These requirements are described in "IEC 61672-1:2002: Precision sound level meters", second edition, of the International Electrotechnical Commission (IEC). To take measurements it is recommended to use a microphone with all-directions sensibility;**

Measurements shall be carried out using the "A" weighting curve also described in "IEC 61672-1:2002". When using a system that includes a periodic monitoring of the A-weighted sound pressure level, a reading should be made at a time interval not greater than 30 ms.

If alternative measuring equipment is used, its overall electro-acoustic performance shall conform to the relevant provisions of IEC 61672-1:2002 for class I instruments."

Paragraph 8.38.1.2., amend to read:

"8.38.1.2. **Calibration of the entire Acoustic Measurement System for Measurement Session:**

At the beginning and at the end of every measurement session, the entire acoustic measurement system shall be checked by means of a sound calibrator that fulfils the requirements for sound calibrators of precision class 1 according to IEC 60942: 2003. Without any further adjustment the difference between the readings shall be less than or equal to 0.5 dB. If this value is exceeded, the results of the measurements obtained after the previous satisfactory check shall be discarded."

Paragraph 8.38.1.3., amend to read:

- "8.38.1.3. **Instrumentation for speed measurements:**
The engine speed shall be measured with instrumentation having an accuracy of ± 2 per cent or better at the engine speeds required for the measurements being performed.
The road speed of the vehicle shall be measured with instrumentation having an accuracy of at least ± 0.5 km/h, when continuous measurement devices are being used.
If independent measurements of speed are being taken, such instrumentation must meet specification limits of at least ± 0.2 km/h."

Paragraph 8.38.1.4., amend to read:

- "8.38.1.4. **Meteorological instrumentation:**
The meteorological instrumentation used to monitor the environmental conditions during the test shall include the following devices, which meet at least the given accuracy:
- (a) temperature measuring device, ± 1 °C;
 - (b) wind speed-measuring device, ± 1.0 m/s;
 - (c) barometric pressure measuring device, ± 5 hPa;
 - (d) relative humidity measuring device, ± 5 per cent."

Paragraph 8.38.1.5., shall be deleted.

Paragraph 8.38.2.1. amend to read:

- "8.38.2.1. **In the tests according to paragraphs 8.38.4.2., 8.38.4.4.2., 8.38.4.4.3. all readings of the sound level meter are to be taken with time weighting "Fast", in the tests according to paragraphs 8.38.4.3, 8.38.4.4.1 all readings of the sound level meter are to be taken with time weighting "Slow".**"

Paragraph 8.38.2.2., shall be deleted.

Paragraph 8.38.3.1.2., amend to read:

- "8.38.3.1.2. The ambient air temperature in which the vehicle is operating shall be in the range -5 to $+35$ °C. The wind ... the measurements.
A value of the ambient air temperature, wind speed and direction, relative humidity, and barometric pressure shall be recorded during the noise measurement interval and shall be stated in the test report."

Paragraph 8.38.3.1.3., amend to read:

- "8.38.3.1.3. **The background noise level in the passenger compartment (driver's cab) must be 15 dB (A) lower than the noise level during testing. Background noise shall be measured inside the passenger compartment (driver's cab) with the vehicle stationary and with all systems and devices that may produce noise switched off. The background noise shall be measured for duration of 10 seconds immediately before and after the series of vehicle tests. The measurements shall be made with the same microphones and microphone locations used during the test. The A-weighted maximum noise pressure level shall be reported.**

Any noise peak which appears to be unrelated to the characteristics of the general noise level of the vehicle shall be ignored when taking the readings."

Paragraph 8.38.3.1.4., amend to read:

"8.38.3.1.4. **Testing shall be performed on a straight dry section of road with bituminous concrete pavement in a good technical condition. The test road shall be hard and as smooth and level as possible, without gaps or ripples or similar macro-irregularities of surface texture which might contribute to the sound levels inside the motor vehicle. The grade and camber of the measurement section must not exceed 2 per cent. The texture depth, measured according to the volumetric method (See ISO 10844:1994 for the description of the measurement procedure) in the area over which the wheels travel must be between 0.3-1.0 mm. The section of the road shall be inspected for compliance with the texture depth requirements at least once a year. The number of measuring points shall be at least 1 every 100 m. The surface shall be dry and free from snow, dust, stones, leaves, etc. Measurements shall not be made under adverse weather conditions. It must be ensured that the results are not affected by gusts of wind."**

Insert a new paragraph 8.38.3.2.1., to read:

"8.38.3.2.1 **General conditions:**

Motor vehicles of the same type shall not have significant differences of interior noise in the following parameters:

- (a) **construction of the body, location of the engine;**
- (b) **length and width of the motor vehicle;**
- (c) **engine type (spark ignition or internal-combustion, two-stroke or four-stroke, piston or rotor), type and construction of the fuel supply and gas exhaust systems, nominal or maximum power and corresponding speed of the crankshaft, type of the electric engine, etc.;**
- (d) **presence of auxiliary systems that are not necessary for the motion, but used during the motive process (heating system, air conditioning and ventilation of the passenger compartment, hereinafter referred to as the ventilation system);**
- (e) **construction of the transmission (with regard to the type of the gearbox, final drive, distributing box, auxiliary gearbox), number of gears and gear ratios;**
- (f) **other systems that may affect the generation of interior noise.**

If a motor vehicle is equipped with an auxiliary (additional) gearbox with manual operation and/or if a vehicle has more than one driven axle, then the selectors shall be put into the position used under normal driving conditions in a city. Additional devices used for moving with slow speed, braking or parking shall be disabled.

Movable seats where the measurements are taken shall be in intermediate position. If the seat back is adjustable, then it shall be in a position convenient for the driver."

Paragraphs 8.38.3.2.1. and 8.38.3.2.1.1. (former), renumber as paragraphs 8.38.3.2.2. and 8.38.3.2.2.1.

Paragraph 8.38.3.2.1.2. (former), renumber as paragraph 8.38.3.2.2.2. and amend to read:

"8.38.3.2.2.2. The tyres used shall be of a type specified by the vehicle manufacturer. If the use of off-road tyres is optional, tyres for road use shall be fitted. ~~The tyres shall be nearly new, but with a minimum wear of 300 km.~~ **The permissible wear of tires shall not exceed 30 per cent of the initial protector height.** The type ... vehicle."

Paragraph 8.38.3.2.1.3. (former), renumber as paragraph 8.38.3.2.2.3. and amend to read:

"8.38.3.2.2.3. If the engine coolant radiators are equipped with devices such as flaps, the measurements shall be carried out with them open. **If the motor vehicle has radiator blinds with manual operation, then the blinds shall be fully opened.**

~~Standard test conditions are with fan operating normally; if a vehicle is fitted with an automatic flap and/or fan, its operating conditions shall be stated in the test report.~~ **If a motor vehicle is equipped with blinds and/or ventilator of the engine cooling system is with automatic drive, then the tests shall be conducted with such devices turned on in automatic regime."**

Paragraphs 8.38.3.2.2. and 8.38.3.2.2.1. (former), amend to read:

"**8.38.3.2.3.** Loading of the vehicle

~~8.38.3.2.2.1.~~ The vehicle shall be unladen. In the cabs ..."

Paragraph 8.38.3.2.3. (former), renumber as paragraph 8.38.3.2.4. and amend to read:

"**8.38.3.2.4.** Openings, windows, auxiliary equipment

Driving measurements ~~Openings such as skylights, all windows and ventilating inlets and/or outlets shall be closed, canvas tops shall be installed if possible. Auxiliary equipment such as windscreen wipers and heating and/or ventilating fans and air conditioners shall not operate during the tests. The operating condition of any automatic auxiliary equipment shall be stated in the test report.~~

During measurement of the noise level according to paragraphs 8.38.4.2., 8.38.4.3., 8.38.4.4.2., 8.38.4.4.3., the ventilation, heating or air conditioning systems shall be switched off, if this is possible. If these systems cannot be switched off, they must be operated in their minimum performance mode."

Paragraph 8.38.4.1.1., amend to read:

"**8.38.4.1.1.** Measurements according to paragraphs 8.38.4.2. to 8.38.4.4. shall be conducted at every microphone location point not less than three times. These results will be calculated as the arithmetic average rounded to the closest integer. If the difference between the maximum and the minimum noise levels at a certain point exceeds 2 dB (A), the test shall be repeated. The maximum value of all the points of measurement shall be considered the final result of the noise level in the passenger compartment."

Paragraph 8.38.4.1.2., amend to read:

"8.38.4.1.2. The presence of clearly audible pure tones or noise of distinct impulse character shall be additionally stated in the test report."

Paragraphs 8.38.4.1.3. to 8.38.4.1.5., shall be deleted.

Paragraph 8.38.4.2.1., amend to read:

"8.38.4.2.1. The procedure for the test is as follows:

The speed (**initial speed V_{start}**) of the vehicle and of the engine shall be stabilized at the specified initial conditions.

When stable conditions are attained, the throttle shall be fully opened as fast as possible and held in this position until either **90 per cent**⁸ of the engine speed for maximum power as specified by the manufacturer of the vehicle ("maximum power speed") or **120 km/h** is reached, whichever is lower (**the final acceleration speed V_{finish}**).

The measurement taken shall be the maximum sound level recorded during the acceleration of the motor vehicle from V_{start} to V_{finish} ."

Paragraph 8.38.4.2.2.1., amend to read:

"8.38.4.2.2.1. Vehicle ~~with a manually operated gear box~~ **with a mechanical gearbox equipped with a manual control.**"

Insert new paragraphs 8.38.4.2.2.1.4. and 8.38.4.2.2.1.5., to read:

"8.38.4.2.2.1.4. If motor vehicles with a maximum speed (with unladen mass of motor vehicle including driver and test operator) at the highest gear lower than the speed corresponding to 90 per cent⁸ of the maximum engine power and lower than 120 km/h the lower gear of the gearbox shall be engaged, but not lower than the 3rd.* The initial speed V_{start} shall correspond to the minimum speed of the crankshaft, which provides constant increase of crankshaft speed with the accelerator pedal completely pressed, but shall not be lower than 45 per cent of the speed that corresponds to the maximum engine power regime. The acceleration shall continue until the motor vehicle reaches the final speed V_{finish} that corresponds to 90 per cent of the maximum engine power regime.

8.38.4.2.2.1.5. If a motor vehicle of category M_2 , M_3 , N_2 or N_3 is equipped with a speed limiter that does not allow reaching a speed corresponding to 90 per cent of the maximum engine power regime in the highest gear, then it is necessary to select a lower gear and accelerate from 45 per cent to 90 per cent of the maximum engine power regime."

Insert new paragraphs 8.38.4.2.3.2. and 8.38.4.2.3.3., to read:

"8.38.4.2.3.2. Motor vehicles equipped with an automatic gearbox not capable of manual gear selection shall be tested in the automatic gear selection mode.

⁸ If the rotational speed of the crankshaft at maximum engine power exceeds 6000 min^{-1} the acceleration to be applied shall be 80 per cent of the rotational speed that would be attained at maximum engine power.

8.38.4.2.3.3. Automatic transmission vehicle with a gearbox capable of forced gear selection.

Vehicles equipped with an automatic gearbox capable of forced gear selection shall be tested only in the forced gear selection mode. This method shall be used if movement is possible in the selected gear.

The gear selected shall be the highest gear (not lower than the second gear if the gearbox has four gears, and not lower than the third gear if the gearbox has five or more gears) that allows the motor vehicle to be driven at a speed not exceeding 120 km/h with the speed of the crankshaft corresponding to 90 per cent ⁸ of maximum engine power regime. The speed reached shall be taken as the final acceleration speed (Vfinish)."

Insert a new paragraph 8.38.4.2.4., to read:

"8.38.4.2.4. Vehicles of all categories with electric drive and trolley-buses

For motor vehicles of all categories with electric drive and trolley-buses, the initial speed Vstart is considered equal to 45 per cent of the maximum speed indicated by the manufacturer. The acceleration is conducted until reaching the final speed Vfinish that corresponds to 90 per cent of the maximum speed indicated by the manufacturer."

Paragraph 8.38.4.2.4. (former), renumber to 8.38.4.2.5. and amend to read:

"8.38.4.2.4. If the ... inoperative.

During testing, at the end of acceleration it is necessary to reach the maximum vehicle speed and crankshaft speed. Measurement shall occur at the beginning at the speed Vstart corresponding to 45 ±5 per cent of the maximum engine power regime, while the motor vehicle speed Vfinish shall not exceed 60 km/h. Forced downshift (kickdown) shall be prevented during acceleration.

If the gearbox shifts to a higher gear before a speed corresponding to 90 per cent ⁸ of maximum engine power regime or 120 km/h is reached, then a speed 5 per cent lower than the speed at which the gear shift occurs shall be taken as the final acceleration speed Vfinal."

Insert a new paragraph 8.38.4.2.6., to read:

"8.38.4.2.6. If a motor vehicle of category M₂, M₃, N₂, or N₃ has a speed limiter that prevents it from reaching a speed corresponding to 90 per cent ⁸ of the maximum engine power regime, then it is necessary to accelerate until reaching a speed 5 per cent lower than the speed at which the speed limiter engages."

Paragraph 8.38.4.2.5. (former), shall be deleted.

Paragraphs 8.38.4.3.to 8.38.4.3.2. amend to read:

"8.38.4.3. Constant speed.

8.38.4.3.1 The noise measurement with the motor vehicle moving at constant speed shall be conducted at the highest gear in the speed range starting from 60 km/h, or 40 per cent of the maximum speed of the motor vehicle, whichever is lower, a speed corresponding to 80 per cent of the maximum speed but not more than 120 km/h, whichever is the lower.

- 8.38.4.3.2** The measurements shall be taken at not less than five values of constant speed rounded to 5 km/h: the lowest, the highest, and intermediate speed values with equal intervals between them. At every point of measurement and in every speed regime, the average value of the readings recorded by the sound level meter during a time interval not shorter than 5 seconds shall be taken."

Insert new paragraphs 8.38.4.4. to 8.38.4.4.3., to read:

"8.38.4.4. Stationary test

8.38.4.4.1. Noise of ventilation systems

The measurements shall be conducted on a stationary motor vehicle with the engine idling (minimum idling speed). During measurements of the ventilation system noise level, air conditioners, heaters or ventilators shall be operated in their noisiest regime designated by the manufacturer for continuous operation when a motor vehicle is in motion. At every microphone location point at least three measurements shall be taken. The results of the measurements shall be recorded in the test report.

8.38.4.4.2. Noise of engine

8.38.4.4.2.1. Stationary tests shall be carried out in neutral gear with the engine operating at the idling speed indicated by the manufacturer.

8.38.4.4.2.2. The measurements shall be conducted on a stationary motor vehicle. The measurements shall be conducted with the engine idling at minimum idling speed until reaching an engine speed equal to:

- (a) 75 per cent of the engine speed at maximum engine power regime, if the value at this regime is lower than 5 000 min⁻¹;
- (b) 3 750 min⁻¹, if the value of the engine speed at maximum engine power regime is between 5 000 min⁻¹ and 7 500 min⁻¹;
- (c) 50 per cent of the engine speed at maximum engine power regime, if the value at this regime is higher than 7 500 min⁻¹.

If the motor vehicle cannot reach the crankshaft speed indicated above, then the final engine speed shall be 5 per cent lower than the maximum engine speed possible for this test regime. The noise level shall be measured during the complete period of engine acceleration, and the maximum reading recorded by the sound level meter shall be considered the result of the measurement.

8.38.4.4.3. Noise produced by discharge of air from the braking system pneumatic valves after their actuation

When measuring the level of noise produced when air is discharged from pneumatic valves after their actuation, the maximum noise level in dB (A) shall be recorded. Noise produced during opening of the pressure regulator shall be measured with the engine idling at minimum idling speed. Noise produced, when air is discharged from the brake system, shall be recorded during the actuation of the service and parking brakes. Prior to each measurement, the air compressor must provide the maximum permissible service pressure, after that the engine shall be switched off."

Paragraph 8.38.5.1.2., amend to read

"8.38.5.1.2. The microphone shall not be closer than 0.15 m to walls, upholstery or persons present. **This requirement does not apply to the distance to the cab roof.** If an assistant is present during the measurement (see paragraph 8.38.6.2.), he must keep at a minimum distance of 1 m from the microphone."

Paragraph 8.38.5.2. amend to read

"8.38.5.2. Microphone position in relation to a seat: Setting of seats and head-restraints (see figure 10, **11** below)."

Paragraph 8.38.6.2.2., the reference to footnote ⁷ and footnote ⁷, renumber as footnote ¹⁰

II. Justification

Paragraph 8.38. and its subparagraphs.: The present text contained in UN R.E.3. is based on the ISO 5128 standard, developed in 1980s. This proposal concerns both specifications of requirements of the measuring equipment, and changes to the test technique due to the development of vehicle design in the last decades.