

**Draft proposal for changes to the text of
TRANS/WP.29/GRB/2005/2/Rev.2 (R51.03)
In order to incorporate the Additional Sound Emission Provisions**

**As changed by the GRBIG ASEP
during the meeting 14 and 15 may 2009**

Text in black is not changed compared to TRANS/WP.29/GRB/2005/2/Rev.2

~~Text crossed out has been removed~~

Text marked in green bold has been changed or added compared to
TRANS/WP.29/GRB/2005/2/Rev.2 and has been agreed by the group

[Text in square brackets still has to be discussed]

Text in blue is proposed to be changed compared to the status of the last meeting and may need
to be confirmed

Text marked in orange bold has been added for clarification to remind the group and or GRB of
earlier discussions or to highlight action points

Main body

6.2.3. Additional sound emission provisions

The additional sound emission provisions apply only to vehicles of categories M1 and N1 equipped with an internal combustion engine.

[Vehicles are deemed to fulfil the requirements of this annex, if the vehicle manufacturer provides technical documents to the type approval authority showing, that the difference between maximum and minimum of the vehicles engine speed at BB' for any test condition inside the ASEP control range defined in 3.3. below (including Annex 3 conditions) does not exceed $0.15 \times (S-n_{idle})$. This article is intended especially for non-lockable CVT's.]

Note: The group wants to exclude some hybrid vehicles from ASEP (in line with the definitions from Reg 83). The group has identified two options for a text:

Note: To be discussed in GRB

Option 1:

Vehicles with a hybrid drive train which have an internal combustion engine with no mechanical coupling to the power train are excluded from ASEP.

Option 2:

In the transitional provisions:

The first [five years] after entry in to force of this regulation, ASEP will not apply to Hybrid Vehicles as defined under regulation 83.

Note: OICA may wish to come forward with additional note to option 2

Note: OICA may wish to come forward with definition of “bigger”N1 vehicles that might be excluded

The additional sound emission provisions are preventive requirements. The purpose of these requirements is to ensure that the sound emission of the vehicle under typical driving conditions different from the conditions of the type approval test in Annex 3 shall not deviate considerably from what can be expected from the Annex 3 test result for this specific vehicle.

6.2.3.1. The vehicle manufacturer shall not intentionally alter, adjust, or introduce any mechanical, electrical, thermal, or other device or procedure solely for the purpose of fulfilling the noise emission requirements as specified in this regulation and as determined by the test procedure of Annex 3 but which will not be operational during typical on-road operation. These measures are commonly referred to as "cycle detection".

This shall not prevent the installation on a vehicle of any control device, function, system or measure if:

- it is activated only for such purposes as engine protection, cold starting or warming up, or
- it is activated only for such purposes as operational security or safety and limp-home strategies.

6.2.3.2. The vehicle shall meet the requirements of annex 10

6.2.3.3. In the application for type approval the manufacturer shall provide a statement (in conformity with Appendix 1 of annex 10) that the vehicle type to be approved complies with the requirements of paragraph 6.2.3 of this Regulation.

~~{6.2.3.3. The sound emission of the vehicle under normal driving conditions different from the conditions of the type approval test in Annex 3 shall not differ considerably from what can be expected from the type approval test result for this specific vehicle with regard to technical practicability. This is fulfilled if the requirements of Annex 10 are met.}~~

8. CONFORMITY OF PRODUCTION

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

8.1. Vehicles approved to this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set forth in paragraph 6. above. The limit values set forth in paragraph 6 and referenced appendices apply with an additional margin of 1 dB(A).

- 8.2. The minimum requirements for conformity of production control procedures set forth in Annex 7 to this Regulation shall be complied with.
- 8.3. 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 one every two years.

Annex 7

CHECKS ON CONFORMITY OF PRODUCTION

1. General

These requirements are consistent with the test to be held to check conformity of production according to paragraph 8. of this Regulation.

2. Testing procedure

The test site and measuring instruments shall be those as described in Annex 3.

2.1. The vehicle(s) under test shall be subjected to the test for measurement of sound of vehicle in motion as described in paragraph 3.1. of Annex 3.

2.2. Compressed air sound

Vehicles having maximum mass exceeding 2,800 kg and equipped with compressed air systems must be subjected to an additional test for measurement of the compressed air sound as described in paragraph 1. of Annex 6.

2.3 Additional Sound Emission Provisions.

The vehicle manufacturer shall assess the compliance with ASEP by an appropriate evaluation (for example, but not limited to, part checks) or may perform the test described in Annex 10.

3. Sampling and Evaluation of the results

One vehicle has to be chosen and subjected to the tests of paragraph 2 above. If the test results fulfill the COP requirements of paragraph 8 of the main body of this regulation, the vehicle is considered to be in compliance with COP.

If one of the test results does not fulfill the COP requirements of paragraph 8 of the main body of this regulation two more vehicles of the same type shall be tested pursuant to paragraph 2 above.

If the test results for the second and the third vehicle fulfill the COP requirements of paragraph 8 of the main body of this regulation, the vehicle is considered in compliance with COP.

If one of the test results of the second or third vehicle does not fulfill the COP requirements of paragraph 8 of the main body of this regulation the vehicle type shall be considered not to conform to the requirements of this Regulation and the manufacturer shall take the necessary measures to re-establish the conformity.

Annex 10

**MEASURING METHOD TO EVALUATE THE COMPLIANCE WITH THE
ADDITIONAL SOUND EMISSION PROVISIONS**
only applicable for vehicles of categories M1 and N1
which are equipped with an internal combustion engine

1. INTRODUCTION

This annex describes a measuring method to evaluate the compliance of the vehicle with the additional sound emission provisions conform paragraph 6.2.3. of this regulation. The expected noise emission in a particular gear ratio is approximated by a linear function of engine speed. The anchor point of this linear function is based on the test results of annex 3. The slope of this linear function is based on actual test results and limited to a maximum value.

Although the vehicle shall meet the requirements in this annex, it is not obligatory to perform actual tests when applying for type approval. It is obligatory for the manufacturer to sign a declaration of compliance conform annex 1. The type approval authority shall have the possibility to ask for additional information about the declaration of compliance and/or carry out the tests as described below.

The analysis of Annex 10 requires the performance of a test according to Annex 3. This Annex 3 test has to be performed under similar conditions on the same track as the tests according to Annex 10.

2. MEASURING METHOD**2.1 measuring instruments and condition of measurements**

Unless specified differently here after, the measuring instruments, the conditions of the measurements and the condition of the vehicle are equal to those specified in Annex 3 paragraph 1 and 2.

If the vehicle has different modes (such as transmission control systems), all these modes shall be in compliance with the requirements in this annex.

2.2. Method of testing

Unless specified differently here after, the conditions and procedures of Annex 3 paragraph 3.1 until 3.1.2.1.2.2. have to be used.

2.3 Boundary conditions

There is a range of valid operation conditions which have to fall within the following boundary conditions:

Vehicle speed V_{AA_ASEP} : $v_{AA} \geq 20$ km/h

Vehicle speed V_{BB_ASEP} :

if n_{BB_ASEP} is reached in one gear $V_{BB} \leq 70$ km/h

in all other cases $V_{BB} \leq 80$ km/h*

Vehicle acceleration a_{WOT_ASEP} : $a_{WOT} \leq 4,0$ m/s²

Engine speed n_{BB_ASEP} : $n_{BB} \leq 2,0 * pmr^{-0,222} * s$ or

$n_{BB} \leq 0,9 * s$ whichever is the lowest

gears $k \leq$ highest gear measured in Annex 3

k not first gear and not reverse

* If the vehicle, in the lowest valid gear, does not achieve the maximum engine speed below 70 km/h, the vehicle speed limit is 80 km/h

2.4 Gear ratios

If the vehicle has various operating modes the vehicle manufacturer shall determine the mode of testing that leads to valid results within the boundary conditions as specified in paragraph 2.3 above. This setup mode shall be documented in the test report.

The ASEP requirements apply to every gear ratio k that leads to test results within the boundary conditions as defined in paragraph 2.3 in this Annex.

In case of vehicles with automatic transmissions, adaptive transmissions and CVT's tested with non-locked gear ratios, the test may include a gear ratio change to a lower range and a higher acceleration. A gear change to a higher range and a lower acceleration is not allowed. A gear shifting which leads to a condition that is not in compliance with the boundary conditions shall be avoided. In that case, it is permitted to establish and use electronic or mechanical devices, including alternate gear selector positions.

2.5 Target conditions

The sound emission shall be measured in each valid gear ratio at the four test points as specified below.

The first test point P_1 is defined by using an entry speed v_{AA} of 20 km/h. If a stable acceleration condition cannot be achieved the speed shall be increased in steps of 5 km/h until a stable acceleration is reached.

The fourth test point P_4 is defined by the maximum vehicle speed at BB' in that gear ratio within the boundary conditions according to paragraph 2.3

The other two test points are defined by the following formula:

$$\text{Test Point } P_j : v_{BB_j} = v_{BB_1} + (j-1)/3 * (v_{BB_4} - v_{BB_1}) \quad \text{for } j = 2 \text{ and } 3$$

where v_{BB_1} = vehicle speed at BB' of test point P_1
 v_{BB_4} = vehicle speed at BB' of test point P_4

Tolerance for v_{BB_j} : +/- 3 km/h

For all test points the boundary conditions as specified in 2.3 shall be met.

2.6. Test of the vehicle

The path of the centerline of the vehicle shall follow line CC' as closely as possible throughout the entire test, from the approach to line AA' until the rear of the vehicle passes line BB'.

At line AA' the accelerator shall be fully depressed. To achieve a more stable acceleration or to avoid a down shift between line AA' and BB' pre-acceleration before line AA' may be used. The accelerator shall be kept in depressed condition until the rear of the vehicle reaches line BB'.

For every separate test run the following parameters shall be determined and noted:

- The maximum A-weighted sound pressure level of the both sides of the vehicle indicated during each passage of the vehicle between the two lines AA' and BB', mathematically rounded to the first decimal place. ($L_{wot,kj}$). If a sound peak obviously out of character with the general sound pressure level is observed, the measurement shall be discarded. Left and right side may be measured simultaneously or separately.
- The vehicle speed readings at AA' and BB' shall be reported with the first significant digit after the decimal place. ($v_{AA,kj}$; $v_{BB,kj}$)
- If applicable, the engine speed readings at AA' and BB' shall be reported as a full integer value. ($n_{AA,kj}$; $n_{BB,kj}$)
- The calculated acceleration shall be determined in accordance to the formulas in annex 3 par 3.1.2.1.2 and reported to the second digit after the decimal place ($a_{wot,test,kj}$).

3. ANALYSIS OF RESULTS

3.1. Determination of the anchor point for each gear ratio

For measurements in gear i and lower, the anchor point consists of the maximum sound level L_{woti} , the reported engine speed n_{woti} and vehicle speed v_{woti} at BB' of gear ratio i of the acceleration test in Annex 3.

$$L_{anchor,i} = L_{woti,annex\ 3}$$

$$n_{anchor,i} = n_{BB,woti,annex\ 3}$$

$$v_{anchor,i} = v_{BB,woti,annex\ 3}$$

For measurements in gear i+1 the anchor point consists of the maximum sound level L_{woti+1} , the reported engine speed n_{woti+1} and vehicle speed v_{woti+1} at BB' of gear ratio i+1 of the acceleration test in Annex 3.

$$L_{anchor,i+1} = L_{woti+1,annex\ 3}$$

$$n_{anchor,i+1} = n_{BB,woti+1,annex\ 3}$$

$$v_{anchor,i+1} = v_{BB,woti+1,annex\ 3}$$

Note: as a consequence of skipping the tyre noise compensation, and meanwhile keeping the anchor point in the regression analysis, the outcome of the regression analysis may have no relation with the expected physical behavior.

3.2 Calculation of the slope of the regression line for each gear

The sound measurements shall be evaluated as function of engine speed according to 3.2.1,

3.2.1 Calculation of the regression line as function of engine speed

The linear regression line is calculated using the anchor point and the four correlated additional measurements.

$$\text{Slope}_k = \frac{\sum_{j=1}^5 (n_j - \bar{n})(L_j - \bar{L})}{\sum_{j=1}^5 (n_j - \bar{n})^2} \quad (\text{in dB/1000 rpm})$$

$$\text{With } \bar{L} = \frac{1}{5} \sum_{j=1}^5 L_j ;$$

$$\bar{n} = \frac{1}{5} \sum_{j=1}^5 n_j ;$$

where n_j = engine speed measured at line BB'

3.2.2 Slope for further calculation

The slope of a particular gear for the further calculation is the derived result of the calculation formula under 3.2.1 rounded to the first decimal place, but not higher than

[X] dB/1000 rpm

3.3 Calculation of the linear noise level increase expected for each measurement

The sound level $L_{\text{ASEP},k,j}$ for measurement point j in gear k shall be calculated using the engine speeds measured for each measurement point, using the slope determined in 3.2 relative to the specific anchor point for each gear ratio.

$$\begin{aligned} L_{\text{ASEP},k,j} &= L_{\text{anchor},k} + (\text{Slope}_k - Y) * (n_{\text{BB},k,j} - n_{\text{anchor},k})/1000 && \text{for } n_{\text{BB},k,j} \leq n_{\text{anchor},k} \text{ and} \\ L_{\text{ASEP},k,j} &= L_{\text{anchor},k} + (\text{Slope}_k + Y) * (n_{\text{BB},k,j} - n_{\text{anchor},k})/1000 && \text{for } n_{\text{BB},k,j} > n_{\text{anchor},k} \end{aligned}$$

Where Y= half the difference in slope below and above the anchor point

3.4 Samples

On request of the type approval authority two additional runs within the boundary conditions according to paragraph 2.3 of the Annex shall be carried out.

4. INTERPRETATION OF RESULTS

Every individual noise measurement shall be evaluated.

The sound level of every specified measurement point shall not exceed the limits given below:

$$L_{kj} \leq L_{ASEP_{kj}} + [Z] + [(Limit_{Annex 3} - L_{urban,Annex 3})]$$

If the measured noise level in a point exceeds the limit, two additional measurements at the same point shall be carried out to verify the measurement uncertainty. The vehicle is still in compliance with ASEP, if the average of the three valid measurements at this specific point fulfills the above specification.

Appendix 1 to Annex 10
(Maximum format: A4 (210 x 297 mm))

Statement of compliance with the Additional Sound Emission Provisions

.....(Name of manufacturer) attests that vehicles of this type
.....(type with regard to its noise emission pursuant to ECE R51) comply
with the requirements of paragraph 6.2.3 of Regulation number 51
..... (Name of manufacturer) makes this statement in good faith, after
having performed an appropriate evaluation of the sound emission performance of the
vehicles.

Date:

Name of authorized representative

Signature of authorized representative: