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ASEP outline

Summary
&
Conclusion

Background Information

- 2005: GRB adopted new test procedure (ISO 362)
- Technical principle:
 - technology neutral vehicle operating conditions to estimate the actual 90th percentile in-use vehicle noise emission
- replicate the actual part throttle operation of in-use vehicles

Concerns from Contracting Parties (CP)

- change in vehicle engine speed (RPM) used during the certification test
- freedom to increase their actual noise emission
- need to prohibit “cheating”
- need to check for ‘nonlinear’ behavior
- need for an additional, independent, set of noise emission stringency on the approval of motor vehicles

What is a “Vehicle of Concern”?

- Common understanding of “Vehicle of Concern” is needed
- TRANS/WP.29/GRB/2005/2:

6.2.3. Additional sound emission provisions

The additional sound emission provisions apply to vehicles of categories M1 and N1 only.

They are preventive requirements intended to also cover driving conditions of the vehicle in real traffic, which can be environmentally relevant concerning their sound emission and which differs from those during type approval, described in Annex 3.

- 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 sound 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".*
- 6.2.3.2. *Any control device, function, system or measure that could affect the sound output may be installed on a vehicle provided that:*
 - *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, or*
 - *it is required to fulfill this and/or other Regulations.*
- 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.*

What is a “Vehicle of Concern”?


Environmentally relevant driving conditions which differ from type approval (6.2.3.)

- L_{Urban} value defines the 90th percentile expected noise emission
 - ASEP should cover the remaining 10 percent of expected noise emission
 - the way for a vehicle to exceed the L_{Urban} value is to accelerate
- ➡ ASEP shall evaluate vehicle performance at other conditions than the operating conditions specified in determining L_{Urban}

What is a “Vehicle of Concern”?

Paragraph 6.2.3.1.

- manufactures shall undertake no measures that would undermine either the letter or the spirit on the noise emission regulations
- The concept of ‘cycle detection’ is well understood in vehicle emission regulations
- e.g. noise increase of 10 dB(A) over a short increment
 - of engine speed? or
 - of vehicle speed?

 ASEP should have a high probability of detecting such behavior

What is a “Vehicle of Concern”?

Paragraph 6.2.3.2.

- Prohibition of “systems” which are only build to increase the sound
- guidance to approval authorities and manufacturers on what sorts of vehicle conditions are not of concern

What is a “Vehicle of Concern”?

Paragraph 6.2.3.2.

- “differ considerably from what can be expected from the type approval test result“
- different parties have different interpretation:

Criteria for determination of vehicle of concern:

- Prohibition on test beating and/or cycle detection.
- Unexpected vehicle noise behavior based on the individual vehicle’s technical capability.
- Noise emission greater than 85 dB(A) anywhere in the ASEP control range.
- Noncompliance with ECE-R51.02 limits.
- Noise emission higher than absolute dB/RPM slope, with different approaches for determining a reference point.
- Allowance for, or prevention of, vehicles with noise emission below type approval limit values to increase noise emissions in the ASEP control range.
- Evaluation of ASEP noise emission using the technical procedures of the base compliance test (L_{Urban}).

 No consensus of the term “vehicle of concern” in the ASEP IG

Differences in how the purpose of ASEP is understood

- Is it to ensure no cheating takes place?
or
- Is it an additional regulatory stringency on vehicle design and technology to provide necessary environmental benefit?

➡ The answer is fundamental to determine the course of ASEP

Agreed operating conditions for ASEP (see GRB-50-10)

1. Vehicle speed range
2. Vehicle acceleration
3. Vehicle engine speed range

Possible approaches for ASEP

1. IG Status

- expected noise emission through an estimation of dB/RPM behavior
- Limitation of the dB/RPM slope
- Account for uncertainty
- Different Levels of stringency possible

Possible approaches for ASEP

2. NL proposal

- “do not exceed” value at an engine speed
- fixed limit between “do not exceed” value and type approval point
- Account for uncertainty
- Bonus for vehicles with type approval value less than limit

Possible approaches for ASEP

3. Modified KBA

- IG Status
- In addition an analysis method to estimate the 51.02 compliance point

Possible approaches for ASEP

4. Do not exceed

- fixed “do not exceed” value

Possible approaches for ASEP


5. L_{Urban}

- This scheme assess any WOT vehicle result by using the one gear L_{Urban} calculation

Consequences of possible approaches

1. IG Status

- detects nonlinear behavior of a vehicle noise emission
- intention is to detect “cycle beating” schemes
- noise emission is limited as a function of engine RPM range
- different levels of stringency possible

 unable to be used for electric or other future advanced propulsion technology vehicles

Consequences of possible approaches

2. NL proposal

- intent is to insure all vehicles do not make more than a specified noise emission, independent of the technology used by the vehicle and independent of the vehicle's type approval value
- method provides independent design and technology stringency on vehicle noise emission
- extra allowance in noise emission for silent cars
- will not be able to detect unexpected nonlinear behavior for some vehicles
- unable to be used for the assessment of electric and future advanced technology vehicles

Consequences of possible approaches

3. KBA/Modified KBA

- provide assurance to governments and regulatory authorities that no matter what the specific technical methods of any new R51 type approval or off-cycle test, a vehicle noise emission would in no case be higher than allowed under ECE R51.02
- KBA proposal could be independent of any ASEP method by requiring a track test to be run

Consequences of possible approaches

4. Do Not Exceed

- no contracting party has specifically proposed this concept
- is incorporated in a certain fashion in the proposal of the Netherlands
- concept is not interested in the behavior of the noise emission as a function of engine RPM, vehicle speed, or any other parameter
- concept of back to back testing for replacement exhaust systems cannot be used
- this concept is suitable for all vehicle technologies

Consequences of possible approaches

5. L_{Urban}

- presented by the Chairman of ISO WG42
- provides an answer to the “As expected” question
- expects noise emission of the vehicle to be proportional to the power output of the engine, using the achieved acceleration as a proxy for the power output
- analysis will identify nonlinear noise behavior either due to changes in noise output or due to failure to produce power (acceleration) during the test
- can be used for all vehicle propulsion technologies

Proposed approach

- each of the concerns expressed by contracting parties has merit
- necessary to balance the goals to achieve a positive result for the environment at a reasonable cost to society
- as off-cycle noise cannot be assessed within the framework of cost-benefit used for the base type approval value; meaning the noise emission under off-cycle will have no effect on L_{eq} values, therefore no calculated benefit to society, decisions must be made on a pragmatic basis

Proposed approach

The package of measures seeks to achieve the following goals:

- 1) All vehicles are subject to ASEP (no exceptions for vehicle technologies).
- 2) Noise emission shall be guaranteed to be at or below noise emission under the current regulation.
- 3) Cycle detection schemes shall have a high probability of being detected.
- 4) The base type approval test shall be the technical stringency for the vehicle.
- 5) Regulators shall have a reasonable assurance that the type approval test covers real world operating conditions.
- 6) ASEP shall provide a basis to perform back to back testing for replacement exhaust systems.

Proposed approach

Specific content of the package:

- 1) Use of the operating condition envelope agreed by the ASEP IG: RPM boundary as function of PMR, 4.0 m/s² acceleration boundary, and vehicle speed between 30 and 80 km/hr
- 2) a) Use of the IG status test points and analysis methods; Parameters chosen as 5 dB/1000 RPM, margin of 2 dB, and edging of 1 dB
or
b) Use 1-gear L_{Urban} method as described by ISO with a limit of 3 dB(A)
- 3) Establishment of an independent control point per KBA proposal to insure noise emission remains as good as under the current regulation
- 4) Modify the base type approval test to change the acceleration boundary from 2.0 m/s² to 3.0 m/s²

Proposed approach

- 1st item: sets the boundary on environmentally relevant operating conditions
takes into account practical test considerations of safety test operations
- 2nd item: provides the means to assess the vehicle's noise behavior consistent with what can be reasonable expected, with a high probability of detecting any cycle beating scheme
- 3rd item: to provide assurance to governments and society in general that the change in technical test methods does not allow for any means of allowing increased noise emission
- 4th item: to provide assurance to governments and society that the test will be carried out in operating conditions deemed to be more representative by governments