GM	WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW7294

Determination of Squeak and Rattle Rating - Complete Vehicle and Subsystem/Component

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.
Note: In the event of conflict between the English and domestic language, the English language shall take precedence.
1.1 Purpose. Determination of the Squeak and Rattle (S&R) Rating of complete vehicles or subsystems/components based on subjectively or objectively detected and rated individual complaints**.**
1.2 Applicability. Applicable to all evaluations of vehicles, subsystems and components on a noise test stand according to:

- Subsystem: GMW7293 or GMW8518 (for Subsystem Test in a Vehicle).
- Vehicle: GMW8518.

1.3 Remarks. In order to assure the comparability and reproducibility of a S&R overall rating for complete vehicles or subsystems/components, it shall be calculated from the summation of individual complaints. The method can be applied both to determine an overall rating for a single evaluated vehicle and to determine the overall rating for subsystems or components. For the overall vehicle rating all detected complaints of the evaluated vehicle shall be considered for the calculation. The rating for a subsystem or a component is based on the ratings of all detected complaints for a definite quantity of subsystems/components (see 4.3.2 for details).

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW7293	GMW7699	GMW8518	GMW14264

2.3 Additional References.

- Component Technical Specification (CTS).
- Subsystem Technical Specification (SSTS).
- Vehicle Technical Specification (VTS).

3 Resources

3.1 Facilities. Test stands and test tracks as specified by the relevant test procedure.
3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.
3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.
3.2 Equipment. As specified by the relevant test procedure.
3.3 Test Vehicle/Test Piece. Completely equipped vehicle or subsystem/component to be evaluated (production intent).

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3.4 Test Time.

Calendar time:	0 days
Test time:	1 hours
Coordination time:	0 hours

Note: Calculation requires approximately 1 h if completed manually and results are immediate if calculations are database integrated.

3.5 Test Required Information. Test procedure for vehicle or subsystem/component.
3.6 Personnel/Skills. Personnel trained in accordance with Standard Operating Procedure requirements.

4 Procedure

4.1 Preparation. Refer to relevant test procedure for vehicle or subsystem/component.
4.2 Conditions. Refer to relevant test procedure for vehicle or subsystem/component.
4.2.1 Environmental Conditions. Refer to relevant test procedure for vehicle or subsystem/component.
4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.
4.3 Instructions. Test shall be performed according to the stipulations of the relevant test procedure for complete vehicles or subsystems/components. All S&R complaints detected under the specified test conditions shall be rated according to GMW14264. Refer to test procedures for complete vehicle or subsystem/component for the rating conditions (distance from the source of noise, seating position in vehicle, etc.) Also record the excitation that induced the noise (driving on even road, simulated rough road conditions, door closing, etc.) If a complaint is discovered under several vehicle or subsystem/component test conditions, only the rating with the highest individual number of Complaint Points (CP) is used to determine the overall rating.
4.3.1 Complete Vehicle. To determine the overall rating of a complete vehicle, take into account all complaints reported for this vehicle under the specified test conditions.
4.3.2 Subsystem/Component. To determine the overall rating for a subsystem/component, it is necessary to conduct the test on multiple subsystems/components of a build phase (if available on different variants) in a vehicle. The number of subsystem/components tested beyond which no appreciable change in the complaints (and/or complaint rating) is noted by the evaluator, is the quantity required to use the algorithm. In case of practical difficulties in obtaining the required number of subsystems/components, the number to be tested is left to the discretion of the engineer conducting the tests. For calculation of the overall rating, all complaints detected during these tests shall be considered. If the same complaint is reported from different component/subsystem tests, use the complaint with the highest Individual Complaint Points (CPi) to determine the overall rating.
If the subsystem/component test is done at a subsystem level (not in a vehicle, but on a shaker), the evaluation is usually more severe and detailed when compared to an in-vehicle test. In such cases, all the complaints identified from a single subsystem evaluation can be used with the single number algorithm without the need for testing multiple subsystems/components.

5 Data

5.1 Calculations.
5.1.1 Complaint Points. To calculate the overall rating, determine the CPi, for each of the relevant complaints (see Appendix A, Figure A1). For this calculation it is necessary to distinguish between complaints reported from high level conditions and those reported from low level conditions. The individual complaint points are calculated using the individual subjective ratings for each of the complaints.
For each complaint detected under high level conditions:

$$CPi_{,\text{high level}} = 89.7*e^{-x} + 3*(10 - x)$$

Where:
x = rating $i_{,\text{high level}}$

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For each complaint detected under low level conditions:

$$CPi_{,low\ level} = 138.6*e^{-y} + 10 - y$$

Where:
y = rating $i_{,low\ level}$
For definitions of high and low level roads (see Appendix D, Table D1).

CP of the complete vehicle or subsystem/component is the sum CPi

$$CP = \sum CPi_{,even\ road} + \sum CPi_{,others}$$

5.1.2 Rating.
5.1.2.1 Overall Vehicle. From this the overall rating of a vehicle under test can be determined (see Appendix B, Figure B1):

$$Rating = 4*e^{-0.001*CP} + 4*e^{-0.007*CP} + 2*e^{-0.05*CP,}$$ Reference Table 1.

Table 1: Complaint Points (CP) Ratings

CP	Rating
CP ≤ 10	Rating = -0.2 * CP + 10
10 < CP ≤ 170	Rating = -0.025 * CP + 8.25
CP > 170	Rating = 4

Note: CP=Complaint Points

5.1.2.2 Subsystem/Component. The overall rating of a subsystem/component can be determined (see Appendix C, Figure C1).
5.2 Interpretation of Results. Compliance with the stipulations of the CTS, SSTS, and VTS.
5.3 Test Documentation. A test report is required for each build phase. The test report shall refer to this test procedure and include the following:

- Name of the vehicle or subsystem/component under test.
- Test procedure applied to the vehicle or subsystem/component under test.
- Name of the test facility and proving ground respectively.
- Test date.
- Build phase of the vehicle or subsystem/component.
- List of detected complaints.
- Conditions under which complaints were detected.
- Rating of complaints per GMW14264.
- Description of remedial measure(s).
- Implementation date(s) of intended/taken measure(s).
- Calculated overall vehicle or subsystem/component rating.
- Vehicle or Subsystem/Component Specification target according to VTS, SSTS, CTS.

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

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