



Hood Vibration Test under Driving Condition

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. This Test Procedure defines the test conditions and requirements for measuring hood vibration under various driving and road condition.

1.2 Applicability. The procedure is applicable for all passenger cars.

1.3 Remarks. Small gaps require a hood with low intrinsic movement. The outcome/background of this test procedure is to make sure the hood:

- has no contact to adjacent parts under the specified driving conditions
- vibration will not have a negative impact on customer satisfaction (if hood or a part of it is visible from the driver and co-driver seat position)

Before starting the measurement, a subjective evaluation of the hood vibration shall be performed according to GMW14264 while driving by the following reason:

- to identify/determine critical points with the highest values of deflection as well as uncritical points
- to provide a subjective estimation if customer satisfaction is fulfilled

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14264

2.3 Additional References. The instructions for the used sensors and measuring system shall be considered.

3 Resources

3.1 Facilities.

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.

3.1.3 Test tracks on the Proving Ground in Dudenhofen or equivalent. The following test tracks and road surfaces are required:

- Circular Track
- Rheinstraße
- Belgian Block

3.2 Equipment.

3.2.1 Laser Sensor (the used sensor shall have a reasonable measuring range suitable for the expected values).

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3.2.2 Measuring amplifier.

3.3 Test Vehicle/Test Piece.

3.3.1 The test vehicle shall be able to reach top speed of the carline.

3.3.2 A second vehicle is necessary for slipstream testing. This additional vehicle must reach at least top speed of the test vehicle. Preferably this vehicle should have a truncated and not a tapered rear to increase the slipstream effect.

Note: Check both vehicles before starting high speed testing such as tire inflation pressure.

3.3.3 The hood and all relevant parts which have an impact on the measurement such as hinges, latch, buffers and seal(s) shall be installed and attached correctly according specification.

3.4 Test Time.

Calendar time: 2 days

Test hours: 6 h

Coordination hours: 3 h

3.5 Test Required Information. The requesting engineer is responsible for providing specifications appropriate to the particular vehicle line being tested (reference VTS/SSTS paragraph numbers if applicable).

Testing worst case scenarios may uncover some potential problems. Discuss with Requesting Engineer if testing should include some worst case scenarios. Depending on which test is being performed and which level of parts or systems is being tested, consider if any of the following may apply: tolerance stack-ups, build variations, misalignment, minimum/maximum fastener torque(s), lubrication, environmental extremes, location of customer representative load application, symmetry (Left Hand vs. Right Hand), color, mold or die source, etc.

The following documents or information are required to run this test:

3.5.1 Vehicle specification.

3.5.2 Tire inflation pressure.

3.5.3 Front closure adjustment (upper or lower tolerance borderline - Target - "as received").

3.5.4 Bumper preload.

3.5.5 Outer panel gap and flushness.

3.5.6 Environmental conditions (temperature, wind speed).

3.5.6 Measuring points (see Appendix A, Figures A1 and A2).

3.5.8 Speed specification (test speed, start of measurement, incremental or steadily increasing of speed).

3.5.9 Distance to the leading vehicle in case of slipstream testing.

3.5.10 Slipstream condition.

3.6 Personnel/Skills. Prior experience in setting up and running similar tests and excellent driving experience.

4 Procedure

4.1 Preparation.

4.1.1 The hood and all relevant parts which have an impact on the measurement such as hinges, latch, buffers and seal(s) shall be installed and attached correctly according specification.

4.1.2 Before starting the test, for both vehicles a safety check is necessary such as tire inflation pressure, etc.

4.1.3 Before starting the measurement, a subjective evaluation of the hood vibration shall be performed according to GMW14264 under the required driving condition to determine critical areas/points.

4.1.4 Test Set Up (example with Laser Sensor).

4.1.4.1 Location and number of laser sensors:

- according the previous subjective evaluation for visible areas
- additional laser for not visible areas but critically rated by the Requesting Engineer

4.1.4.2 Sensor brackets/supports and the laser sensors shall be attached-vibration free.

4.1.4.3 The exact position of all measuring points (shall be documented in a sketch to ensure reproducibility).

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4.1.4.4 Cable routing of the sensors shall be installed carefully: clearance between hood and cable under fully latched condition of the hood is necessary for a correct measurement (see Appendix A, Figures A3 and A4).

4.1.4.5 Any possible deviations which may affect the measurement shall be documented.

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 Unless otherwise specified in this document, the test shall be performed at an ambient temperature of $(+22 \pm 3) ^\circ\text{C}$. Drive tests under a higher or lower temperature should be documented in the test report.

4.2.1.2 Environmental Conditions (Weather). The measurements shall be performed only under dry weather condition due to the high speed requirement. For safety reason dry and ice-free road conditions are obligatory.

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.

4.2.2.1 Drive Test. Slipstream testing only on a closed Circular Track.

4.2.2.2 Measuring Device. A potential temperature-dependency of the sensors shall be considered.

4.3 Instructions.

4.3.1 Measuring the Hood Vibration. The whole test consists of characteristic road and drive conditions: Good and bad road condition, high speed and with and w/o slipstream.

4.3.1.1 Free Driving up to Top Speed on the Circular Track. The measurement shall be performed on the Circular Track. The Circular Track allows a uniform driving without braking. This is a precedent condition for the necessary transient oscillation of the hood and the recording time. A leading vehicle is not necessary.

The test speed(s) shall comply with the requirements of the Requesting Engineer. A transient oscillation time of ≈ 10 s shall be considered before starting the measurement. A record time of 10 s minimum is recommended.

4.3.1.2 Slipstreaming up to Top Speed on a Circular Track. The measurement shall be performed similar to paragraph 4.3.1.1 under slipstream condition. For this test a leading vehicle is necessary. This vehicle shall be at least as fast as the test vehicle.

Slipstream conditions:

- changing the lane (moving into and out of the lane of the leading vehicle)
- following the leading vehicle on the same lane at a short distance
- following the leading vehicle parallel at a short distance

Distance and slipstream condition according to requirements. All test condition and deviations shall be documented.

4.3.1.3 Test Run on the "Rheinstraße". This measurement shall be performed without a leading vehicle at a speed of 60 km/h. Transient oscillation time 5 s minimum and record time according to paragraph 4.3.1.1.

4.3.1.4 Test Run on "Belgian Blocks". This measurement shall be performed without a leading vehicle at a speed of 25 km/h. Transient oscillation time 5 s minimum and record time according to paragraph 4.3.1.1.

5 Data

5.1 Calculations. Conversion of digital values in measurable values (software).

Proposal: Test frequency 500 Hz

5.2 Interpretation of Results. The subjective evaluation according to GMW14264 and the analysis of the test records give information about the vibration behavior of the hood. It allows a prediction of customer satisfaction and solidity of the hood.

5.3 Test Documentation. The test results and deviations of this test procedure shall be summarized in a measurement report according to Appendix A, Figure A5 and Appendix B and C. All parameters mentioned in paragraph 4.3.1 shall be noted in the test report.

5.3.1 Hood Vibration. All digital recordings shall be presented in a deflection-time diagram (see Appendix A, Figure A5) and the maximum and minimum values recorded in the attached test sheets (see Appendix B and C).

5.1.2 Classification. Gauß distribution of measured values.

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