



Mirror Lens Vibration Evaluation Procedure

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. To measure and analyze the data associated with mirror lens vibration. For mirror assemblies as installed in a full vehicle, the criterion is the dynamic angle of rotation as measured when the vehicle is driven over a road surface at constant speed.

1.2 Applicability. This test procedure is appropriate for the evaluation of both outside rear view mirror (OSRVM) lens and inside rear view mirror (ISRVM) lens vibration performance.

1.3 Remarks. The criteria described in this procedure are needed to objectively assess vibration performance of mirror assemblies.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14172

2.3 Additional References.

- PCB Piezotronics accelerometers available via www.pcb.com
- Vehicle Technical Specification (VTS)

3 Resources

3.1 Facilities. The tests shall be performed on the designated test roads at each GM regional site, see Appendix E for details.

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.

3.2.1 Portable Data Acquisition System and Response Transducers. The data acquisition system (DAS) shall have at least three (3) measurement channels per mirror with an external trigger or four (4) measurement channels. See Appendix A for more detailed information.

3.2.2 Accelerometers. Use three (3) small (≤ 2 g) uni axial accelerometers. See Appendix A, Tables A1 thru A3 for examples.

3.2.3 Event Marker. An event marker or similar trigger may be used to trigger data acquisition.

3.2.4 Miscellaneous Equipment. Including but not limited to:

3.2.4.1 Appropriate Bayonet Neill-Concelman (BNC) and microdot cables.

GM Confidential

© Copyright 2016 General Motors Company All Rights Reserved

October 2016

Page 1 of 11

3.2.4.2 Microdot to BNC adapters.

3.2.4.3 Adhesive substances, see guidelines provided in Appendix B, Table B1 and Figures B1 and B2.

3.2.4.4 Transducer signal conditioning as required.

3.3 Test Vehicle/Test Piece. Record vehicle information on the Mirror Test Data/Log Sheet, see Appendix D. Record VIN, GM fleet number and the build stage (if appropriate). Also, record the testing date, time and location.

Note: It is important to have a vehicle with the correct tires.

3.4 Test Time.

Calendar time: 1 day

Test time: 6 hours

Coordination time: 1 hour

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. One (1) person is required to perform the tests described in this procedure. This person shall be trained in the use of vibration recording and analysis instrumentation. Knowledge of good signal processing practices is also required. This person shall have successfully completed the regional safety and training classes required to use the test roads in that region.

4 Procedure

4.1 Preparation.

4.1.1 Prep Vehicle. Check the vehicle according to 3.3. Adjust tire pressures to nominal values as stated by the vehicle manufacturer (cold). The vehicle is unladen except for the driver and the measuring instruments. Only after formal approval from Vehicle Program Team management, remove approved camouflage that would affect localized mirror vibration performance. Do not remove vehicle camouflage that does not affect mirror vibration testing.

4.1.2 Verify Transducer Calibration. See GMW14172.

4.1.2.1 Verify Acquisition System Calibration. See GMW14172.

4.2 Conditions. All regional safety requirements and applicable laws must be followed during the course of testing.

4.2.1 Environmental Conditions. The wind speed shall be less than 9 m/s. The air temperature shall be between 5 °C and 35 °C, and temperatures shall not vary more than 6 °C during a given test unless otherwise specified.

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. Mount response transducers to component to be measured, according to Appendix B, Figures B1 and B2. The following (typical) acquisition parameters are recommended:

- Channel Trigger (or external trigger)
- Hanning Window (with amplitude correction)
- Alternating current (AC) Coupled (1 Hz high pass filter)
- Overload Detection On

4.3.1 Set Dynamic Ranges. Range shall be set such that at least half of the Analog-to-Digital Converter (ADC) range is utilized. This is usually done through an autoranging process of the measurement channels.

4.3.2 Data Acquisition.

4.3.2.1 Prepare Acquisition System. Arm DAS. Wait for signal conditioning to settle (Typically 1 minute to 2 minutes). Verify data quality as described in 4.3.2.5. Acquire five (5) runs of the conditions described in 4.3.2.2 thru 4.3.2.4.

4.3.2.2 Variant A, Low Speed Structural Excitation. The road test shall be performed on a surface which adequately excites all significant structural modes of vibration (suspension, body, powertrain, large mass components, etc.), see Appendix E for the regional road that applies.

GM Confidential

© Copyright 2016 General Motors Company All Rights Reserved

October 2016

Page 2 of 11

4.3.2.3 Variant B, Cruising Speed Structural and Aerodynamic Excitation. The road test shall be performed on a surface which adequately excites all significant structural modes of vibration (suspension, body, powertrain, large mass components, etc.) and also includes significant aerodynamic excitation. See Appendix E for the regional road that applies.

4.3.2.4 Variant C, High Speed Aerodynamic Excitation. The road test shall be performed on a surface which is smooth, and includes primarily aerodynamic excitation. See Appendix E for the regional road that applies.

4.3.2.5 Verify Measurements. Acquire an initial set of data for each road surface prior to final data collection runs. Observe time domain signal. Look for inconsistencies in the data such as overloads, dropouts, signal conditioning saturation (peak and exponential drop in time domain signal) and quantization errors. If inconsistencies are observed, troubleshoot the transducer/acquisition system (look for malfunctioning accelerometers and cables/connectors, check ADC, etc.) If no inconsistencies are observed, acquire and store data.

5 Data

5.1 Calculations. Identify the peak (maximum) amplitude and corresponding frequency from the response spectrum. See analysis methods in Appendix C. Record using test data/log sheet found in Appendix D.

5.2 Interpretation of Results. Verify if VTS targets are achieved.

5.3 Test Documentation. Not applicable.

6 Safety

This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

In general, a risk assessment needs to be performed for every driving instruction prior to executing this standard. (**Note:** National law needs to be considered while performing a risk assessment.) The required rating of risk by exposure probability and possible violation will be done in a separate document. Every identified risk must be named inside the risk assessment for the relevant driving instruction in order to announce that risk to employees. Within the risk assessment, the vehicle equipment and different vehicle build stages have to be considered. After performing a risk assessment, non-acceptable risk needs to be mitigated by appropriate countermeasures. Here technical measures are preferred because these are independent from attendant circumstances. In case technical measures are not appropriate, organizational and/or personal measures will apply. This includes training, wearing of Personal Protection Equipment, or arrangement of idle time.

6.1 Safety Precautions.

6.1.1 Instrumentation and other test equipment must be securely mounted in accordance with proving grounds traffic safety guidelines for mounting and usage of in-vehicle instrumentation.

6.1.2 All running lights and vehicle safety features must be operational according to proving grounds rules for running lights and power windows. Exterior lights must not be obscured by styling add-ons, covers or camouflage packages. The horn may be disabled because of steer angle transducer installation.

6.1.3 A helmet is required in accordance with the regulations of the test facility. The vehicle should never be operated in a manner where the vehicle leaves the roadway or goes onto the shoulder for any reason.

6.1.4 Check for proper attachment of the steering wheel to the gear via the intermediate shaft. If it feels loose or abnormal, do not run the test until the parts are properly assembled according to the intended design.

6.1.5 Check to be certain that all wheel lugs are present and have the specified torque. Loose or missing wheel fasteners are to be replaced, installed or tightened before the test may begin.

6.1.6 The driver's seatbelt must be worn at all times during the test. Passengers accompanying the test operator must also be safely belted in the vehicle, preferably in the right rear seat.

Note: Passengers are allowed for observation or training purposes.

6.1.7 If a crossbar is used to hold the steering wheel angle transducer base plate, the passenger side airbag is to be disabled or disconnected.

GM Confidential

© Copyright 2016 General Motors Company All Rights Reserved

October 2016

Page 3 of 11



Documents

Document Sharing Hub

7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations, and Symbols.

@	at
°	degrees
#	number
AC	alternating current
ADC	Analog-to-Digital Converter
BNC	Bayonet Neill-Concelman
CPG	Cheong-na Proving Ground
DAS	Data Acquisition System
GMB	GM Brazil
GMDAT	GM Daewoo Automotive Technology
GME	GM Europe
GMH	GM Holden
GMNA	GM North America
ISRV	Inside Rear View Mirror
Max.	Maximum
MPG	Milford Proving Ground
N&V	Noise and Vibration
OSRV	Outside Rear View Mirror
PATAC	Pan Asian Technical Automotive Center
rms	root mean square
SDC	Stud Damaged Concrete
VPO	Vehicle Performance Owner

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Test to GMW8502

9 Release and Revisions

This standard was originated in November 2001. It was first approved by Advanced Integration – Interior Noise & Wind Noise – Noise & Vibration Integration Center in June 2003. It was first published in October 2003.

Issue	Publication Date	Description (Organization)
1	OCT 2003	Initial publication.
2	DEC 2005	Added Appendix E Regional Facility Road System. Added other GMW reference procedures (Global N&V Structure-borne Vibration Harmonization Team)
3	DEC 2011	Clarified acronyms, updated equipment to be specific per mirror, updated vehicle camouflage test requirements, and added an additional speed to 4.3.2.3 variant C. (Global N&V Structural Vibration VPO Team)
4	OCT 2016	Revised to current template. (Global N&V VPO Team – Structural Vibration)

GM Confidential

© Copyright 2016 General Motors Company All Rights Reserved

October 2016

Page 4 of 11