



Powertrain Mounting Rigid Body Modes 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. The purpose of this test procedure is to determine the in-vehicle rigid body natural frequencies and corresponding mode shapes of a powertrain in the 0 Hz to 40 Hz frequency range.

1.2 Applicability. This test procedure is appropriate for benchmarking competitive and GM passenger vehicles in the full vehicle state. This procedure is valid for use with both Body Frame Integral (BFI) and Body on Frame (BOF) full vehicles.

The testing standards defined in this document are intended to pertain only to work being done for the corporate database and validation. Other testing methods and interpretations are useful and valid, and should continue to be used for normal powertrain mounting system development work where appropriate.

1.3 Remarks. Data from in-vehicle powertrain rigid body modal surveys is often used as a means of describing the performance of GM and competitive powertrain mounting systems.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW8477 GMW14172 GMW14229

2.3 Additional References. None.

3 Resources

3.1 Facilities. See GMW8477.

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. See GMW8477.

3.3 Test Vehicle/Test Piece. The test piece shall be any full vehicle of either BFI or BOF construction that represents current release status. Deviations shall either be corrected or noted. The requester shall fully describe the condition of the full vehicle if it features non-standard content.

3.4 Test Time.

Calendar time: 2 days
Test time: 8 hours
Coordination time: 2 hours

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3.5 Test Required Information. The trimmed structure should be verified to ensure that there are no system groundouts or extra mass/parts in the interior or in the trunk.

3.6 Personnel/Skills. To complete this test, one (1) technician and/or one (1) engineer skilled in vibration data acquisition, analysis, equipment use, and test setup is required.

4 Procedure

4.1 Preparation.

4.1.1 Obtain full vehicle Description, Test Data Log, and Transducer Location forms (see GMW8477, Appendix C). Enter appropriate information.

4.1.2 Full Vehicle Preparation.

4.1.2.1 Thoroughly inspect the full vehicle to ensure that requirements specified in 3.3 and 3.5 are met.

4.1.2.2 Fill all fluid reservoirs in the full vehicle, including fuel tank, radiator, overflow tank, brake fluid reservoirs, engine oil, transaxle fluid, power steering reservoir, etc.

4.1.2.3 Weigh the full vehicle. Record weight in the full vehicle description.

Note: Test weight does not include instrumentation.

4.1.2.4 The vehicle should be washed to ensure clean surfaces for adhesion of transducers.

4.1.3 Component Preparation.

4.1.3.1 Adjust tilt steering columns to eliminate any relative angle between the lower and upper steering column. For a telescoping column, locate the column at the midpoint of its travel.

4.1.3.2 Adjust steering wheel to the center position with the column lock engaged.

4.1.3.3 Set the fore/aft seat adjustments fully rearward.

4.1.3.4 Close all doors, windows, and hatches tightly.

4.1.4 Instrumentation Calibration.

4.1.4.1 Transducer System Calibration. See GMW14172.

4.2 Conditions.

4.2.1 Environmental Conditions. See GMW8477.

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.

4.3.1 Shaker Location and Orientation Determination.

4.3.1.1 Locate the shakers. Identify a shaker location as close as practical to directly below the powertrain Center of Gravity (CG). This shaker's primary function will be to excite the bounce mode. Identify a second shaker location significantly away from the CG and the powertrain's torque axis. This shaker's primary responsibility will be to excite as many of the other five (5) rigid body modes as possible. In the event that some modes are insufficiently excited, a 3rd shaker may be necessary. Choose locations based upon:

- Appropriate orientation to excite desired modes.
- Available attachments on powertrain (e.g., unused bosses or flat surfaces for mounting driving point blocks).
- Ability to locate, orient and secure the shakers.

4.3.1.2 Orient the shaker inputs. Choose the input of the first (bounce) shaker to be nearly vertical. Orient the input of shakers 2 and 3 (if necessary) to be appropriate for the modes to be excited.

4.3.1.3 Attach Driving Point Blocks. See GMW8477.

4.3.2 Force Level Determination. Force levels should be selected that put enough energy into the powertrain to excite it and yet not overdrive the powertrain mount system beyond the desired response range (i.e., nominal idle range and higher road response range).

4.3.2.1 Set and maintain the Acquisition Parameters per GMW8477.

4.3.2.2 Set initial excitation amplitude. Starting with the bounce shaker, set shaker input voltage to achieve the threshold of sensation (i.e., increase voltage until you can just feel the powertrain vibrating at a point furthest

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