



Body Structure Interface Attachments – Drive Point Dynamic Stiffness Level 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.

The Transducer Calibration Master Test Procedure, GMW14172 and the Hand Held Force Input Frequency Response Function (FRF) Acquisition Master Test Procedure, GMW14181, shall be referenced for more detailed information corresponding the following procedure.

1.1 Purpose. Define the process for obtaining the drive point dynamic stiffness/drive point mobility level on the body at interfaces to the suspension, cradle, frame, wipers, Electronic Leveling Compressor (ELC), exhaust, induction, and driveline/powertrain. These measurements are used to compare body mobility to the specifications.

1.2 Applicability. This test procedure is appropriate for use with all car and truck body systems.

1.3 Remarks. The drive point dynamic stiffness/mobility level of the body at the subsystem interfaces is a factor in isolation performance.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW8702 GMW14172 GMW14181

2.3 Additional References.

- Subsystem Technical Specifications (STS)

3 Resources

3.1 Facilities. A test room or an area which is free of extraneous vibration (per GMW14181).

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 Test Equipment.

- Data acquisition system with FRF analysis capability.
- Accelerometer (weight less than 0.011 kg).
- Small or medium impact hammer with tip capable of providing uniform force input out to 800 Hz or hand held shaker and force transducer.

Note: See Appendix A, **Transducer Examples**, found in GMW14181 for transducer key characteristics.

3.2.2 Test Fixtures. See GMW14181 for test fixture specification and examples.

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3.3 Test Vehicle/Test Piece. The complete trimmed body, trimmed structure or body structure. Vehicle shall be in the appropriate state as defined in GMW8702.

3.4 Test Time.

Calendar time: 2.25 days

Test hours: 16 hours

Coordination hours: 2 hours

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. As described in GMW14181.

4 Procedure

4.1 Preparation. Attach test fixtures (if necessary) at appropriate interface attachments. Test fixtures shall be fabricated to model a boundary condition that reflects what the test item experiences in operation. Torque input, due to off-set force input, shall be avoided. Unless otherwise stated in the test order, use the GMW14181 described GM standard coordinate directions. Torque attachment bushings to design specified readings and ensure fixture is tight. Mount the body on four (4) rubber isolation blocks (100 N/mm to 300 N/mm rate) or pneumatic springs to approximate a free-free mounting boundary condition.

4.2 Conditions.

4.2.1 Environmental Conditions. As described in GMW14181.

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. Test conditions are described in GMW14181.

4.3 Instructions.

4.3.1 Set up a data acquisition system to acquire accelerance FRF in the units of meters per second squared per Newton ($\text{m/s}^2/\text{N}$) from 0 Hz to 800 Hz with at least 1 Hz resolution.

4.3.2 Instrument a body interface attachment with an accelerometer.

4.3.3 Using an impact hammer or hand held shaker, apply a force at the same body interface attachment in the same direction. Continue measuring driving point FRFs in three (3) orthogonal directions at all of the body interface attachment points. Reference GMW14181 for GM standard vehicle coordinate directions and appropriate accelerometer mounting adhesives.

Note: An impact hammer must be used for force input on lightly damped attachments such as exhaust hangers. Using a hand held shaker can give incorrect results due to the dynamic mass of the hand held shaker.

4.3.4 For each measurement, measure accelerance, check coherence and verify levels. Upon measurement completion, store accelerance FRF, coherence and force auto-power spectrum.

5 Data

5.1 Calculations. This section describes methods to calculate the data for both target validation and root cause analysis.

5.1.1 Data calculations for target validation.

5.1.1.1 One-third ($\frac{1}{3}$) octave drive point dynamic stiffness spectrum.

5.1.1.1.1 Integrate the narrow band accelerance to obtain mobility.

5.1.1.1.2 Calculate $\frac{1}{3}$ octave mobility according to Appendix C in GMW14181.

5.1.1.1.3 Integrate the $\frac{1}{3}$ octave mobility to $\frac{1}{3}$ octave compliance.

5.1.1.1.4 Invert the compliance to obtain dynamic stiffness.

5.1.1.1.5 Recalculate the units from N/m to kN/mm.

5.1.1.1.6 Display:

X-axis: 20 Hz to 800 Hz, $\frac{1}{3}$ octave scale.

Y-axis: linear full scale, either 0.1 kN/mm to 5 kN/mm or 1 kN/mm to 50kN/mm, based on data peak amplitude.

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