Air Induction System Interface Attachments - Drive Point Dynamic Stiffness and Mobility Level Evaluation Procedure

1 Introduction

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

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. Define the process for obtaining the air induction system drive point dynamic stiffness/mobility at vehicle interfaces to compare to air induction system attachment drive point dynamic stiffness/mobility specifications.

1.2 Applicability. This test procedure is appropriate to use for all car and truck air induction systems.

1.3 Remarks. The drive point dynamic stiffness/mobility of the air induction system at the vehicle interfaces is a factor in the isolation performance of the attachment, see GMW14181.

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 GMW14181

2.3 Additional References.

Subsystem Technical Specification (SSTS)

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 Data acquisition system (DAS).

3.2.2 Accelerometer (weight less than 0.006 kg).

3.2.3 Small impact hammer with tip capable of providing uniform force input out to 800 Hz.

3.2.4 Transducer cabling.

3.2.5 Signal conditioning. See GMW14181, Appendix A, Table A2 for transducer key characteristics.

3.3 Test Vehicle/Test Piece. The complete air induction system including all components with designed vehicle attachments, see GMW14181.

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3.4 Test Time.

Calendar time:	0.5 day
Test time:	2 hours
Coordination time:	2 hours

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. To complete this test, at least 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. Place induction system on 8 cm to 10 cm of acoustic foam for free-free mounting boundary condition, see GMW14181.

4.2 Conditions. See GMW14181.

4.2.1 Environmental Conditions. See 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.

4.3 Instructions.

4.3.1 Using an impact hammer, apply a force at each of the vehicle attachment points on the induction system in three (3) orthogonal directions. See GMW14181 for GM standard vehicle coordinate directions and appropriate accelerometer mounting adhesives.

4.3.2 Set up a DAS to acquire acceleration over force FRF (accelerance) in the units of meters per second squared per Newton [$(m/s^2)/N$] from 0 Hz to 1024 Hz with at least 1 Hz resolution.

4.3.3 For each impact, measure accelerance, check coherence, verify levels and store all required drive-point responses, see GMW14181.

5 Data

Data may be presented in four (4) ways:

- One-Third (⅓) octave drive point dynamic stiffness spectrum
- One-Third (⅓) octave mobility spectrum
- Narrow band mobility spectrum
- Narrow band drive point dynamic stiffness spectrum

5.1 Calculations.

5.1.1 One-Third (⅓) Octave Drive Point Dynamic Stiffness Spectrum.

5.1.1.1 Integrate the narrow band accelerance to obtain mobility.

5.1.1.2 Calculate ⅓ octave mobility spectrum according to GMW14181, Appendix C.

5.1.1.3 Integrate the ⅓ octave mobility to obtain ⅓ octave compliance.

5.1.1.4 Invert the ⅓ octave compliance to obtain dynamic stiffness.

5.1.1.5 Recalculate the units from [N/m] to [kN/mm].

5.1.1.6 Display:

X-axis: 20 Hz to 800 Hz (⅓ octave scale)

Y-axis kN/mm, log scale

5.1.2 One-Third (⅓) Octave Mobility Spectrum.

5.1.2.1 Integrate the narrow band accelerance to obtain mobility.

5.1.2.2 Calculate ⅓ octave spectrum according to GMW14181, Appendix C.

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