



Air Induction System - Panel Mode Frequency Evaluation

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.

Note: The Hand Held Force Input Frequency Response Function Acquisition Master Test Procedure, GMW14181, shall be referenced for more detailed information corresponding to the following procedure.

1.1 Purpose. Define the process for obtaining the first panel mode frequency of any panel or surface of an air induction system. The product of this procedure will be a frequency value in Hertz (Hz).

1.2 Applicability. This test procedure is appropriate for any panel or surface on any passenger car or light truck air induction system.

1.3 Remarks. The induction panel modes directly impact air induction system radiated noise performance. It is generally desired that the first panel mode, at operating temperature, will be higher than the frequency associated with engine firing order at maximum rated engine speed. This test evaluation and associated analytical evaluations for panel modes are intended to assist in the development of the Air Induction System (AIS) structure. Compliance with the Panel Mode Best Practice will enable, but not ensure, the system to comply with the radiated noise requirement. The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement (Best Practice AIRIND-3).

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14181

2.3 Additional References.

- Panel Mode Best Practice AIRIND-3
- Subsystem Technical Specification (SSTS)

3 Resources

3.1 Facilities. A test room or an area which is free of extraneous vibration. Refer to 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 PCB-352A24 accelerometer or equivalent.

3.2.3 PCB-086C80 small impulse hammer with tip capable of providing uniform force input out to 800 Hz or equivalent (available from PCB Piezotronics).

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3.2.4 Transducer cabling and signal conditioning.

3.2.5 Refer to GMW1418, Appendix A, Table A2 for transducer key characteristics.

3.3 Test Vehicle/Test Piece. The complete AIS including all components with radiating surfaces or panels.

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 AIS on 75 mm to 100 mm of acoustic foam for a free-free mounting boundary condition. Refer to GMW14181.

4.2 Conditions.

4.2.1 Environmental Conditions. Refer to 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. Refer to GMW14181 for appropriate accelerometer mounting adhesives.

Mount an accelerometer near the center of each radiating surface, normal to the surface.

Using an impact hammer, apply a force near the center of each radiating surface normal to the panel.

Set up the DAS to acquire the acceleration per unit force FRF (accelerance) from 0 Hz to 800 Hz with 1 Hz resolution.

For each induction surface, measure accelerance, check coherence and record the frequency of the first panel mode.

5 Data

5.1 Calculations. Refer to GMW14181. The frequency of induction panel modes measure at room temperature will be 5% to 10% higher than those measure at operating temperature. For induction systems measured at room temperature, reduce the panel frequency by 10% when comparing its value to the target value specified at operating temperature.

5.2 Interpretation of Results. The resulting panel frequencies including temperature effects will be directly comparable to the AIS engineering level recommended value for panel mode frequency included in the AIS Subsystem Technical Specification (SSTS).

5.3 Test Documentation. Refer to GMW14181.

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.

7 Notes

7.1 Glossary.

Accelerance: For a point excitation of a mechanical system, this is the complex ratio of acceleration to applied force.

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