Electrically Powered Component - Free Acceleration Evaluation Procedure

1 Scope

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 Operating Data Acquisition Master Test Procedure GMW14227 shall be referenced for more detailed information corresponding to the following.

1.1 Purpose. Define the process for quantifying the component/bracket assembly free acceleration levels at the vehicle attachment locations for electrically powered components.

1.2 Foreword. The free acceleration of an electrically powered component is one of the factors affecting structure-borne noise. This quantity, with others, can be used to calculate forces into the body or be combined to predict noise levels in the vehicle passenger compartment.

1.3 Applicability. This test procedure is appropriate to use for electrically powered system actuated and customer actuated components that can be tested free-free without additional mount fixturing, complex line routing, complex electronic controls or complex fluid controls. Example components include, but are not limited to, the following:

1.3.1 Secondary air injection (SAI) pumps.

1.3.2 Air suspension system compressors used for electronic leveling and/or air suspension control.

1.3.3 Brake system electric vacuum pumps.

1.3.4 Fuel system electric vacuum pumps used in evaporative leak check modules (ELCM).

1.3.5 Low temperature coolant pumps used for:

- Heating core cooling.
- Electric rear differential module (RDM) cooling.
- High voltage battery cooling.
- Powertrain electric control module cooling such as the transmission power inverter module (TPIM), the electric motor/generator unit (MGU), the starter/generator control module (SGCM), or to the powertrain electronics box (PEB).

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 GMW14227
GMW14172

3 Resources

3.1 Facilities. A test room (see GMW14227).

3.2 Equipment.

3.2.1 Data acquisition system.

3.2.2 External voltage supply.

3.2.3 Small accelerometers (weight less than 0.006 kg).

3.2.4 Transducer dabbling and signal conditioning.

3.3 Test Vehicle/Test Piece. A representative component with bracket assembly and cabling including appropriate electrical connection is required. Hardware to restrict air/fluid flow or air shocks with air lines may be required.

3.4 Test Time.

Calendar time:	1 day
Test hours:	6 hours
Coordination hours:	2 hours

3.5 Test Required Information. Appropriate component operating voltage range.

3.6 Personnel/Skills. See GMW14227.

4 Procedure

4.1 Preparation. Using elastomeric cords, suspend the test piece as oriented in the vehicle to approximate free-free boundary conditions.

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Manipulate the elastic compliance to less than a 1 Hz rigid bounce mode.

Note: Do not overly constrain the test piece. Elastomeric cord stiffness should be as low as possible.

Inlet and outlet air lines of the component should be routed as necessary to maintain appropriate air restriction. Liquid fluid lines should be routed to and from the appropriate fluid supply.

4.2 Conditions.

4.2.1 Environmental Conditions. See GMW14227.

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 Calibration Verification. Check equipment for valid calibration date. Replace out of date equipment. Perform equipment calibration verification (see GMW14172).

4.3.2 Data Acquisition. Set up a data acquisition system to acquire narrow band, linear acceleration spectra from 0 Hz to 1600 Hz with 1 Hz resolution in the units of m/s^2. Apply Root Mean Square (RMS) averaging to the data using a Hanning window with enough averages to achieve stable amplitude values.

4.3.2.1 Operate the component with an external voltage supply. Increment the applied voltages between 9 V and 15 V, or other appropriate voltage range as experienced in vehicle (e.g., some components may require pulse width modulation). Using lightweight accelerometers, monitor the tri-axial acceleration responses at each of the vehicle attachment locations. Identify the applied voltage results in the highest acceleration levels.

4.3.2.2 Operate the component at the voltage identified in the previous step. Measure the tri-axial acceleration responses at each of the vehicle attachment locations.

5 Data

5.1 Calculations. Calculate the free acceleration vector magnitude for each attachment point. The acceleration vector magnitude is equal to the square root of the sum of the squares of the individual tri-axial responses as follows:

$$A_i = \sqrt{(A_x^2 + A_y^2 + A_z^2)}$$

Convert the acceleration magnitude for each attachment location to the units of dB (reference: 1 m/s^2).

5.2 Interpretation of Results. Compare the acceleration vector magnitude for each attachment point to the targeted values as specified in the appropriate Subsystem Technical Specification (SSTS) or Component Technical Specification (CTS). The acceleration magnitudes must meet the target levels for all attachment points at all appropriate operating voltages.

5.3 Test Documentation. Standardized formats contained in the appropriate Global SSTS and CTS template.

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. See GMW8702.

7.2 Acronyms, Abbreviations, and Symbols.

CTS	Component Technical Specification
ELCM	Evaporative Leak Check Module
MGU	Motor/Generator Unit
PEB	Power Electronics Box
RDM	Rear Differential Module
RMS	Root Mean Square
SAI	Secondary Air Injection
SGCM	Starter/Generator Control Module
SSTS	Subsystem Technical Specification
TPIM	Transmission Power Inverter Module

8 Coding System

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

Test to GMW14386

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