



SURFACE VEHICLE RECOMMENDED PRACTICE

J2380™

DEC2021

Issued 1998-01
Revised 2021-12

Superseding J2380 DEC2013

Vibration Testing of Electric Vehicle Batteries

RATIONALE

Revisions were made to this document to be consistent with information in the Cooperative Research Program SAE/NHTSA DOT HS 812 717 report. Vibration tables and figures were enhanced for accuracy. Test equipment and instrumentation sections were updated.

FOREWORD

This document provides a test procedure for characterizing the effect of long-term, road-induced vibration and shock on the performance and service life of electric vehicle batteries. For mature, production-ready batteries, the intent of the procedure is to qualify the vibration durability of the battery. Either swept sine wave vibration or random vibration is typically used for the performance of such testing. Random vibration is the focus of this document.

The vibration tests defined in this procedure are based on rough-road measurements at locations likely to be appropriate for mounting of traction batteries in electric vehicles. The data were analyzed to determine an appropriate cumulative number of occurrences of shock pulses at various given G-levels over the life of the vehicle. The vibration envelopes shown in Figure 1 correspond to approximately 100000 miles of usage at the 90th percentile. The vibration spectra contained in this procedure have been designed to approximate this cumulative exposure envelope. For testing efficiency, a time-compressed vibration regime is specified to allow completion of the test procedure in a minimum of 13.6 hours and a maximum of 92.6 hours of testing, depending on the type of shaker table available and the choice of acceleration levels.

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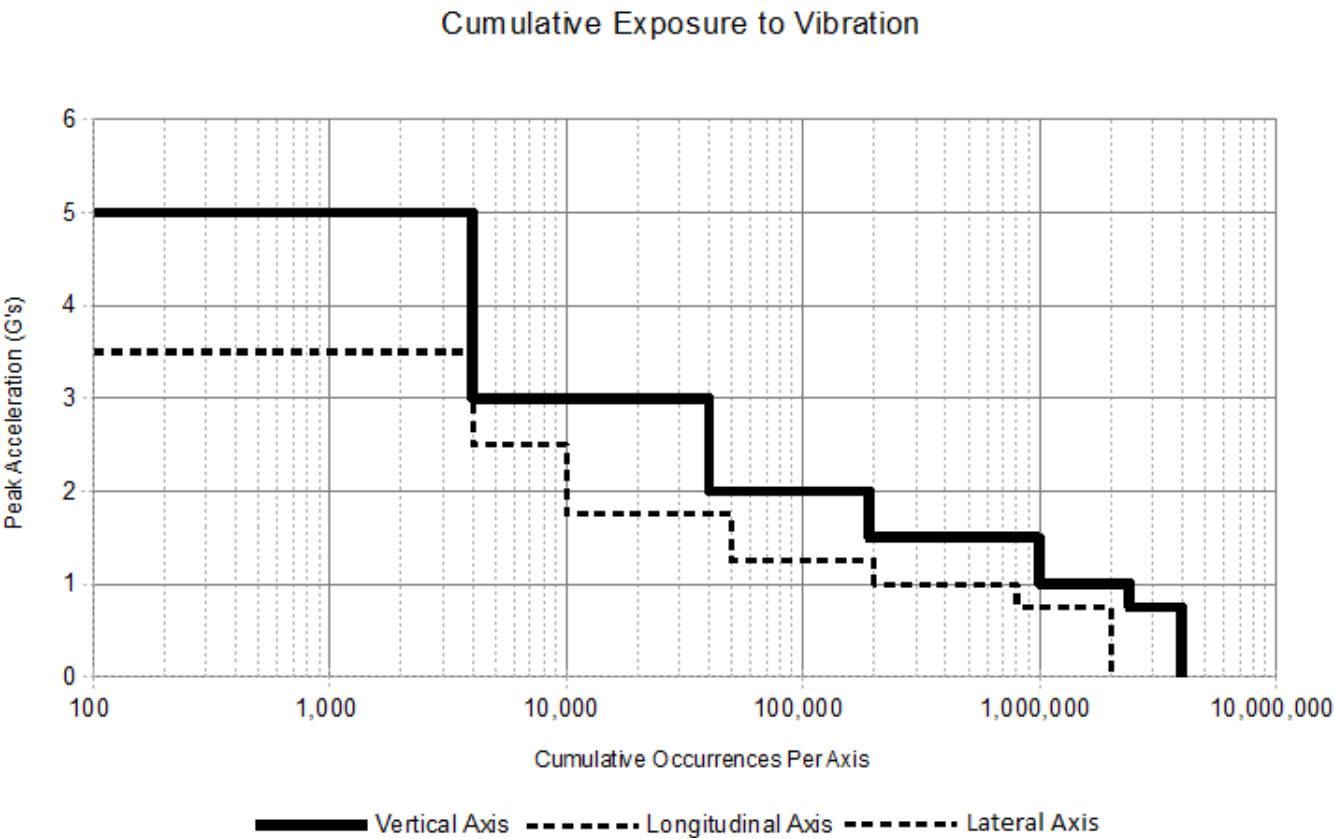


Figure 1 - Cumulative vibration envelopes

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1. SCOPE

This SAE Recommended Practice describes the vibration durability testing of a single battery (test unit) consisting of either an electric vehicle battery module or an electric vehicle battery pack that is typically greater than 200 kg in mass and structurally integrated as part of the vehicle. For statistical purposes, multiple samples would normally be subjected to such testing. Additionally, some test units may be subjected to life cycle testing (either after or during vibration testing) to determine the effects of vibration on battery life. Such life testing is not described in this procedure; SAE J2288 may be used for this purpose as applicable. Finally, impact testing, such as crash and pothole, are not included in this procedure. SAE 2464 describes abusive/safety shock tests.

Preferably, a specific vibration durability profile should be developed based on actual vehicle measurements for the specific electric vehicle application.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1715	Hybrid Electric Vehicle (HEV) and Electric Vehicle (EV) Terminology
SAE J1715/2	Battery Terminology
SAE J1766	Recommended Practice for Electric, Fuel Cell and Hybrid Electric Vehicle Crash Integrity Testing
SAE J1798	Recommended Practice for Performance Rating of Electric Vehicle Battery Modules
SAE J2288	Life Cycle Testing of Electric Vehicle Battery Modules
SAE J2464	Electric and Hybrid Vehicle Rechargeable Energy Storage System (RESS) Safety and Abuse Testing
SAE J2929	Safety Standard for Electric and Hybrid Vehicle Propulsion Battery Systems Utilizing Lithium-based Rechargeable Cells

2.2 Related Publication

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 IEC Publications

Available from IEC Central Office, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41 22 919 02 11, www.iec.ch.

IEC 60068-2-6 Environmental Testing- Part 2 Test-Test Fc Vibration (Sinusoidal)

2.2.2 USABC Publication

Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, Tel: 703-605-6000, www.ntis.gov.

USABC Electric Vehicle Battery Test Procedures Manual, Revision 2, January 1996. Obtainable by mail order as Report No. DOE/ID-10479, Rev. 2. http://avt.inl.gov/energy_storage_lib.shtml.