GM	WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW15242

Structural Durability - Laboratory Definitions

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.

1.1 Purpose. The purpose of this document is to define terms commonly used by the General Motors Structural Durability Laboratories.

1.2 Applicability. All General Motors Structural Durability Laboratory Test Procedures.

1.3 Remarks. This procedure is intended to be a reference for all General Motors Structural Durability Laboratory test procedures.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14794	GMW15189	GMW15245	GMW15445

3 Resources

Not applicable.

4 Procedure

Not applicable.

5 Data

Not applicable.

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

7 Notes

7.1 Glossary. The following is a list of definitions commonly used by the General Motors Structural Durability Laboratories.

7.1.1 Audit Torque. A process used to determine the audit (static) torque necessary to rotate a threaded fastener after tightening or at the end of test. Measure on torque (audit torque) (i.e., torque in the tightening direction until movement of the fastener is observed) for assembled fasteners.

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7.1.2 Auto-Spectral Density (ASD). A function in the frequency domain that shows the strength of a signal at each frequency band for a stationary random signal, The ASD function should not be used for transient signals. The area under the auto-spectrum between any two frequency limits f1 and f2 gives the mean square value of the data within that frequency range. The ASD contains no phase information. It is used to evaluate frequency content of the signal and in the calculation of frequency response functions and coherence. The ASD function is a special case of the Cross-Spectral Density (CSD), where the two signals used to generate the CSD are the same. Also referred to as a Power Spectral Density (PSD).

7.1.3 Automated Site Controller (ASC). Refer to Test Site Controller (TSC).

7.1.4 Ballast. The weights added to a test specimen to bring the mass up to one of the ballast conditions.

7.1.5 Ballast Condition. One of several specified mass load conditions of a vehicle or test specimen. Refer to GMW15445 for details.

7.1.6 Baseline Fatigue Damage. Fatigue damage or pseudo-damage calculated from the correlation responses or other channels in the original response data sets.

7.1.7 Brake Intensifier. An external device that can be activated to apply brake line pressure to a vehicle or test specimen to simulate brake events.

7.1.8 Break Wire. A loop of electrical wire connected to a system interlock that is attached to the test specimen in such a way that it will detect part separation and/or movement and interrupt the test site operation.

7.1.9 Coherence. The measure of the ratio of the frequency domain of the output signal to the input signal for a system. The coherence of the input to the output is linear with a maximum ratio of 1.

7.1.10 Configuration Files. Data sets containing the data acquisition and channel description parameters used for multiple drive and response files. These parameters include full-scale values of each channel in engineering units and channel descriptors. This terminology is specific to MTS System Corporation equipment.

7.1.11 Correlation. See Laboratory Simulation Quality.

7.1.12 Correlation Parameters. Parameters from the test specimen used to assess the laboratory simulation quality. These usually include iteration and correlation responses.

7.1.13 Correlation Response. Measured responses from the correlation transducers on the test specimen after iterations are completed. The measured responses are typically compared to Road Load Data Acquisition (RLDA) vehicle responses.

7.1.14 Correlation Transducer. A transducer used on the RLDA vehicle and the test sample to assess the laboratory test correlation. These transducers are typically located in areas of interest.

7.1.15 Cross-Spectral Density (CSD). The Cross-Spectral Density (CSD) is the multiplication of the output Fourier transform by the input Fourier transform averaged over the complete sample data set. In a laboratory test, this is usually a response file (output) and drive file (input). The area under the curve of a CSD is equal to the covariance of the two signals.

7.1.16 Deletion Files. Out-of-date term. See Region Files (7.1.58).

7.1.17 Desired Responses. Response time history file intended to be reproduced on the test specimen in the laboratory. A typical example is an edited and filtered (filtered to desired control bandwidth) response time history file.

7.1.18 Drive File. Time history files containing the command signals for the hydraulic actuator servo controllers. The drive file development process attempts to reproduce the desired response from the remote parameter transducers located on the suspension.

7.1.19 Drive File Generation Process. A process that calculates the drive files by using the desired response and the frequency response function of the test rig/specimen system response to generate the test rig command signals. The iterative process accommodates for non-linear phenomena in the test rig/specimen system. For each iteration, the filtered response of the current drive file is compared to the filtered desired response file. Any differences between the two files are used as the basis for correction to the drive file. The result is a reproduction of the filtered desired responses in the specimen mounted on the test rig.

Software typically used: MTS RPC Pro and MTS RPC3.

7.1.20 Durability Matrix. The data set used by the Test Site Controller to define the repeats and the playback sequence for drive files during testing. Also commonly referred to as a Playback Matrix. See Sequence File (7.1.68).

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7.1.21 Durability Module. A sequence of defined road events. A durability test is comprised of multiple durability modules.

7.1.22 Event-Action File. A file used by the MTS 498 Test Site Controller to define actions to be taken during drive file playback when pre-defined events or interlock/limits occur.

7.1.23 Fatigue Damage. A cyclical fatigue value calculated from strain or load time histories, expressed as the fraction of one durability life to initiate cracks on a test specimen. Usually based on strain-life calculations.

7.1.24 Fixed-Reacted. A test method by which rigid body motion is controlled by the input forces applied directly to the rigid body. In procedure GMW14794, the rigid body is fixed to a bedplate and the input forces are applied to the suspension.

7.1.25 Fixture Design Bill of Materials (BOM). A list of test fixtures and equipment needed to construct a particular test rig. Typically, this is obtained from the local fixture design group.

7.1.26 Frequency Response Function (FRF). The linear relationship at discrete frequencies, including amplitude and phase, between an input (drive) and an output (response) over a particular frequency bandwidth. Usually, the FRF is displayed as a matrix plot of amplitude vs. frequency and phase vs. frequency.

7.1.27 Gate Review. A meeting between project personnel, including the test requester, to review the test plan, progress, and correlation. The two gate reviews typically performed are the Project Plan Gate Review and Test Correlation Gate Review.

7.1.28 GMWxxxx. General Motors Worldwide Test Procedure registration number, where xxxx is the test procedure number.

7.1.29 Gross Vehicle Mass (GVM)/Gross Vehicle Weight (GVW) Ballast Condition. The GVM (GVW) ballast condition is defined as loading the vehicle to its listed Gross Vehicle Mass Rating GVMR (GVWR). Refer to GMW15445 for details.

7.1.30 Hard Fixture. A design of steel tubing and plates configured to provide representative suspension attachment locations.

7.1.31 Incident. Result of the test specimen not meeting the defined technical specification.

7.1.32 Inertia-Reacted. A test method by which rigid body motion on a sprung mass is generated by its own inertia responding to input forces applied to the unsprung mass. In the procedure GMW15189, the sprung mass is the body/frame and the unsprung mass is the suspension.

7.1.33 Interlocks. Electrical monitoring system that interrupts a test or turns-off hydraulics when a monitored signal deviates from an operator specified range.

7.1.34 Internal Gate Review. Same as a Gate Review without the test requestor present. There is typically an internal gate review performed for data editing results.

7.1.35 Iteration. The process of correcting drive files for errors caused by non-linear system characteristics not comprehended by the inverse expanded linear FRF**.**

7.1.36 Laboratory Road Simulation. To duplicate road load data at transducer location points remote from the suspension multi-axial test system inputs.

7.1.37 Laboratory Simulation Quality. A measure of how well the laboratory test reproduces the road responses. This differs from test quality, which addresses ongoing test repeatability. An equivalent term is correlation. Refer to GMW15245 for details.

7.1.38 Light Vehicle Mass (LVM)/Light Vehicle Weight (LVW). The LVM (LVW) ballast condition is defined as curb mass + driver's mass + test equipment. This is the same as driver + test curb mass. Driver mass is estimated at 70 kg (154 lb). The test equipment mass is estimated at 45 kg (100 lb). Actual mass should be used whenever possible. This is not possible when multiple drivers are to be used.

7.1.39 Load Bearing Mount. A bracket containing one or more rubber bushings primarily designed to support the weight of the powertrain.

7.1.40 Logbook. A record of all activities and actions performed to set up, develop and run a durability test. The record can be a collection of paper or electronic documents.

7.1.41 Mini-RLDA. The measurement of road responses for a small number of channels on a test specimen prior to laboratory testing. The events recorded are used to verify test correlation and/or to adjust test rig drive files to account for changes to successive test specimens (i.e., Belgian Blocks and Potholes).

7.1.42 MTS 329LT Road Simulator. A multi-axial road simulation system designed for use on light trucks.

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