GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW3428

Passenger Vehicle Established Road Regions Structural Durability Test

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. To provide a common GM global structural durability evaluation of a passenger vehicle. This test procedure provides severe chassis structural inputs representing vehicle usage in markets with established road systems (i.e., North America, Western Europe, Japan).

1.2 Applicability. This test procedure is applicable to passenger vehicles. In general, vehicles classified as passenger vehicles are intended to transport passengers and have relatively small cargo hauling capability (e.g., sedans, coupes, hatchbacks and crossover vehicles).

1.3 Remarks. This standard is intended as the basis for structural laboratory tests and analytical modeling. The core test provides the basis for laboratory and/or road evaluation (when appropriate) of structural subsystems and components. This test has been developed to reflect customer usage of markets with established road systems. These regions have more stable road systems and lesser amounts of unpaved and rough roads.

1.3.1 The events repeated to the specified number of times provide 241 350 km (150 000 mi) of high and medium amplitude structural inputs for severe customer usage. Structural inputs are defined as vertical, lateral, fore-aft, chassis torsion, and full steering events. Inputs other than these are present at a much lower severity and are incidental to obtaining the representative structural inputs.

1.3.2 Due to the abbreviated nature of this test procedure, the less damaging and often time consuming inputs are greatly reduced or eliminated.

1.3.3 While GMW3428 is intended to cover global established road systems, the test does not encompass all known customer usage treatments or road types. Some of the limitations are due to the accelerated nature of the test and some are due to the constraints of the test site environment and test facilities. Additionally, the database for defining the worldwide vehicle operating environment is evolving and periodic content changes to GMW3428 are expected.

1.3.4 If more rigorous exposure to unique customer usage treatments is desired, other specialized testing should be considered as part of the overall vehicle dependability test plan. Some considerations should be given to the following:

- GMW15016 Cold Weather Exposure Test
- GMW15730 Hot Weather Exposure Test
- GMW18048 Desert Off-Road Structural Test (for vehicles with off-road capability)

1.3.5 Results of this test should be regarded as highly probable to also occur in the hands of some customers inasmuch as the module contains vehicle treatments based on measured customer vehicle operation. This procedure specifies vehicle operation designed to match data collected on groups of randomly selected customer's vehicles. The intent of the test is to subject the vehicle to the treatment of a greater than average severity customer for each of the measured structural inputs.

2 References

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

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2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3238	GMW15445	GMW15709	GMW16980
GMW3241	GMW15550	GMW15715	GMW17168
GMW3423	GMW15553	GMW15728	GMW18048
GMW14264	GMW15554	GMW15730	
GMW15016	GMW15556	GMW16887 (ID)	
GMW15444	GMW15557	GMW16933	

(ID) = This standard is limited to internal distribution within General Motors and shall not be distributed outside this company. Contact the GM Lead Engineer for further instructions.

2.3 Additional References.

2.3.1 CheongNa.

DL.CN.BFC-1	DL.CN.DRC-2	DL.CN.PHC	DR.CN.FBS
DL.CN.BFC-2	DL.CN.HSC	DL.CN.STC-1	DR.CN.SB
DL.CN.BFC-4	DL.CN.JTC	DL.CN.STC-2	
DL.CN.CSC	DL.CN.MPC	DL.CN.SWC	
DL.CN.DRC-1	DL.CN.PBC	DL.CN.TWC	

2.3.2 Cruz Alta.

DR.CA.1060	DR.CA.1258	DR.CA.1312	DR.CA.1327
DR.CA.1061	DR.CA.1296	DR.CA.1313	DR.CA.1401
DR.CA.1062	DR.CA.1300	DR.CA.1316	
DR.CA.1064	DR.CA.1301	DR.CA.1321	
DR.CA.1075	DR.CA.1302	DR.CA.1326	

2.3.3 Dudenhofen.

DR.DH.13°	DR.DH.DR-E01b	DR.DH.Parking	DR.DH.TH
DR.DH.16°	DR.DH.DR-E02	DR.DH.PB	DR.DH.TTE0
DR.DH.Bsnubs	DR.DH.FS-WTBR	DR.DH.PH-1&2	DR.DH.vmax+
DR.DH.City	DR.DH.Hill	DR.DH.RA-1	QM AADVKA01
DR.DH.DR-3	DR.DH.IP	DR.DH.Roll	QM AADVKA02
DR.DH.DR-E01a	DR.DH.JT	DR.DH.SpBmp	QM AADVKA05

2.3.4 Guangde.

DR.GD.AZ	DR.GD.JT	DR.GD.SD	DR.GD.ZE
DR.GD.CS	DR.GD.PB	DR.GD.TD	DR.GD.ZN
DR.GD.CY	DR.GD.PS	DR.GD.TW	DR.GD.ZO
DR.GD.DB	DR.GD.PX	DR.GD.TZ	DR.GD.ZX
DR.GD.DP	DR.GD.PY	DR.GD.ZA	DR.GD.ZY
DR.GD.EW	DR.GD.PZ	DR.GD.ZB	
DR.GD.FB	DR.GD.Q5	DR.GD.ZC	

2.3.5 Lang Lang.

DR.LL.1GMC2	DR.LL.7AR	DR.LL.7HC	DR.LL.8PT
DR.LL.41G0	DR.LL.7AS	DR.LL.7JT	DR.LL.8SB
DR.LL.43G0	DR.LL.7CS4	DR.LL.7SN	DR.LL.8TC
DR.LL.4PER	DR.LL.7FBS	DR.LL.7TC3	DR.LL.BB40
DR.LL.71G0	DR.LL.7GGD	DR.LL.7TS	DR.LL.DW13
DR.LL.7A	DR.LL.7GMC	DR.LL.8	DR.LL.DW16

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2.3.6 Milford.

DL.MF.AZ	DL.MF.EB	DL.MF.PY	DL.MF.WE
DL.MF.BP	DL.MF.EG	DL.MF.PZ	DL.MF.WF
DL.MF.CS	DL.MF.EX	DL.MF.Q5	DL.MF.WH
DL.MF.DP	DL.MF.JT	DL.MF.S7	DL.MF.WS
DL.MF.DS	DL.MF.MC	DL.MF.TZ	DL.MF.XF
DL.MF.DT	DL.MF.PX	DL.MF.VM	

3 Resources

3.1 Facilities. General Motors Proving Grounds.

- CheongNa Proving Ground (Korea)
- Cruz Alta Proving Ground (Brazil)
- Dudenhofen Proving Ground (Germany)
- Guangde Proving Ground (China)
- Lang Lang Proving Ground (Australia)
- Milford Proving Ground (USA)

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 Some method of accurate speed indication should be provided to the driver for accurate execution of the driving modules.

3.2.2 Some type of acceleration/deceleration rate indicator should also be provided to the driver.

3.3 Test Vehicle/Test Piece. Test vehicle equipped as specified.

3.4 Test Time.

Calendar time:	0 d
Test time:	365 h to 925 h (proving ground dependent)
Coordination time:	0 h

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. If data measurements are required the driving instructions which comprise this test are intended to be performed by personnel specifically trained in the proper execution of the driving instructions. Refer to the appropriate proving ground driving instruction documents and related risk assessments.

Different driver license requirements, knowledge of test content, and mandatory health checks for involved personnel have to be considered.

4 Procedure

4.1 Preparation. Current maximum allowable vehicle speed to be supplied by test responsible personnel to ensure the vehicle is operated safely. If the vehicle is equipped with a manual transmission, the shift point speeds should also be determined and provided.

Measurement of adjustments and settings may be made as deemed necessary to document the condition of the vehicle. These measurements must be made without significantly affecting the adjustment or setting being considered. The intent of these measurements is to document the condition of the vehicle without changing the state of the original assembly.

Vehicles being operated on this test for any other purposes (e.g., design evaluation) should be prepared in a manner appropriate to that particular test intent.

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4.2 Conditions.

4.2.1 Environmental Conditions. For data acquisition, in situations where severe weather makes certain driving events unsafe they should be postponed until road conditions improve.

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.

Road Load Data Acquisition (RLDA) measurements of some events should only be run during dry road conditions [e.g., aggressive brake events, standing start wide open throttles (WOT)], otherwise peak loads may be reduced due to tire slip.

Limited environmental shielding of transducers and other instrumentation may require that loads acquisition be postponed during wet road conditions.

4.2.3 Ballast. Ballast definitions are explained in GMW15445 Vehicle Ballast. The ballast calculation data sheets in Appendix B or Appendix F of GMW15445 should be used to determine the proper ballast mass.

4.2.3.1 Body Frame Integral (BFI) Architectures without Configurable Cargo Area – Sedans/Coupes/Hatchbacks (Excludes Police Vehicles) and Station Wagons with Configurable Cargo Area. Analyses of fatigue damage and peak loads show that these vehicles can be tested at Structural Vehicle Mass (SVM) and do not require testing at two ballast conditions. One exception is for Pothole #3.

4.2.3.1.1 Pothole #3. In order to obtain rear vertical suspension peaks, one cycle of Pothole #3 must be executed at the Gross Vehicle Mass (GVM) ballast condition.

4.2.3.2 BFI Architectures with Configurable Cargo Area – Crossovers, Passenger Vans, SUVs (Excludes Police Vehicles and Station Wagons). Analyses of fatigue damage and peak loads show that crossovers and similar vehicles should be tested using two ballast conditions. This test specifies the cycle repeats to be executed at Light Vehicle Mass (LVM) and GVM. For more information about ballasting of configurable cargo areas, refer to GMW15445 Vehicle Ballast.

4.3 Instructions. Perform the driving instructions listed in “Specified Events – Cycles at Ballast” (Appendices A through F, Tables A1 through F2).

4.3.1 Anti-lock Brake System. If the vehicle is not equipped with an Anti-lock Brake System (ABS), or if the system is inoperative, this content should be deleted for the test.

4.3.2 Traction Control System. If the vehicle is not equipped with a Traction Control System (TCS), or if the system is inoperative, this content should be deleted for the test.

4.3.3 Additional Test Content. Additional test content can be run in conjunction with the base test content to meet specific needs.

4.3.3.1 Additional Powertrain Mount Laboratory Test Content. For laboratory tests that include powertrain mount loads, City content is performed in addition to the base test content.

GMW15550 Durability Event: City provides information for the two global City Course layouts. Five laps of the Large City Course provide similar operation to eight laps of the Small City Course. Some proving grounds have the Large City Course while others have the Small City Course. CheongNa Proving Ground does not have a City Course.

For powertrain mount testing, this test specifies to add 5000 laps of the Large City Course or 8000 laps of the Small City Course.

4.3.4 Steering Attachment Validation. Steering attachment validation is performed using GMW16887 Test Input Method for Steering Gear to Cradle Test.

4.3.5 Test Scheduling Guidelines. In order to subject the vehicle to a reasonable simulation of customer usage in a linear manner of operation, distribute the driving routes as evenly as possible throughout the test.

All miscellaneous mileage accrued during the execution of this test should be driven at posted speeds and consist of light accelerations/ decelerations, minimizing any conflicts with existing durability traffic and avoiding any abusive treatments.

4.3.6 Driver Responsibilities. During the execution of the test, the driver is to observe vehicle behavior (as would a customer) and inform the responsible individuals through written comment whenever a malfunction occurs or unusual behavior is experienced.

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The proper execution of this durability test is highly dependent on close driver adherence to the schedules and the instructions contained therein. This is because accurate correlation with field experience can only be achieved by means of tailored combinations of vehicle speed, road surface, and driving maneuvers.

4.3.7 Maintenance Scheduling Guidelines. Test vehicle maintenance/repair will be based on Owner's Manual recommendations and, as closely as possible, customer maintenance/repair practices.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. In general, the structural durability test contains a more complete distribution of loads and therefore, represents customer usage better than the structural content in the general durability test.

5.3 Test Documentation. With reference to this test procedure the test results shall be presented in a test report. Written and photographic documentation is to be generated and maintained on all factors involved in the test.

All involved parties should agree upon and follow established standards regarding the appropriate documentation for the test (e.g., RLDA workbooks and checklists, data recorder setup files, test incident reporting).

5.4 Subjective Rating Scale. The subjective rating scale should be used to document subjective evaluations of fluid leaks, squeaks & rattles, disturbances, performance items and seat comfort. Refer to GMW14264 Subjective Rating Scales for more information.

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.

In general, a risk assessment needs to be performed for every driving instruction prior to executing this standard. (**Note:** National law needs to be considered while performing a risk assessment.) The required rating of risk by exposure probability and possible violation will be done in a separate document. Every identified risk must be named inside the risk assessment for the relevant driving instruction in order to announce that risk to employees. Within the risk assessment, the vehicle equipment and different vehicle build stages have to be considered. After performing a risk assessment, non-acceptable risk needs to be mitigated by appropriate countermeasures. Here technical measures are preferred because these are independent from attendant circumstances. In case technical measures are not appropriate, organizational and/or personal measures will apply. This includes training, wearing of Personal Protection Equipment, or arrangement of idle time.

6.1 Safety Precautions.

6.1.1 Instrumentation and other test equipment must be securely mounted in accordance with proving grounds traffic safety guidelines for mounting and usage of in-vehicle instrumentation.

6.1.2 All running lights and vehicle safety features must be operational according to proving grounds rules for running lights and power windows. Exterior lights must not be obscured by styling add-ons, covers or camouflage packages. The horn may be disabled because of steer angle transducer installation.

6.1.3 A helmet is required in accordance with the regulations of the test facility. The vehicle should never be operated in a manner where the vehicle leaves the roadway or goes onto the shoulder for any reason.

6.1.4 Check for proper attachment of the steering wheel to the gear via the intermediate shaft. If it feels loose or abnormal, do not run the test until the parts are properly assembled according to the intended design.

6.1.5 Check to be certain that all wheel lugs are present and have the specified torque. Loose or missing wheel fasteners are to be replaced, installed or tightened before the test may begin.

6.1.6 The driver's seatbelt must be worn at all times during the test. Passengers accompanying the test operator must also be safely belted in the vehicle, preferably in the right rear seat.

Note: Passengers are allowed for observation or training purposes.

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6.1.7 If a crossbar is used to hold the steering wheel angle transducer base plate, the passenger side airbag is to be disabled or disconnected.

7 Notes

7.1 Glossary. Refer to GMW15444 Global Durability Test Instructions and Definitions for terms and definitions. Refer to GMW15445 for definitions of ballast related terms.

7.2 Acronyms, Abbreviations, and Symbols.

ABS Anti-Lock Braking System
BFI Body Frame Integral
GVM Gross Vehicle Mass
LVM Light Vehicle Mass
PPE Personal Protection Equipment
RLDA Road Load Data Acquisition
SVM Structural Vehicle Mass
TCS Traction Control System
WOT Wide Open Throttle

8 Coding System

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

Test to GMW3428.

9 Release and Revisions

This standard was originated in January 2003. It was first in January 2003. It was first published in October 2004.

Issue	Publication Date	Description (Organization)
1	OCT 2004	Initial publication.
2	FEB 2008	Pothole #3 was included for all regions (4 cycles). Hokkaido Proving Ground was removed and Beijing and Ding Yuan Proving Grounds were added. (Test Advisory Group/PUMA)
3	JUL 2013	Five year refresh; removed Ding Yuan Proving Ground and added CheongNa and Guangde Proving Grounds; replaced L Turns with J Turns. (Global Proving Ground Durability Test Development Team)
4	OCT 2014	Removed Beijing Proving Ground test content; Added Speed Bump event; Replaced High Speed 200 km/h with High Speed Vmax where applicable; Added words related to safety items (QRD-Global Durability Test Development Team)
5	JUN 2017	Removed Millbrook Proving Ground test content. Added requirement for BFI Architectures without Configurable Cargo Area and Station Wagons with Configurable Cargo Area vehicles running at SVM to execute one cycle of Pothole #3 at the GVM ballast condition. Added LVM/GVM test tables for BFI Architectures with Configurable cargo area. Reduced Speed of Belgian Blocks and Pave A/B/C for Guangde. Added 7.2% Extended Grade Chatters to Milford test. (QRD-Global Durability Test Development Team)
6	AUG 2018	Removed reference to GMW14048; Added reference to GMW18048 Desert Off-Road Test; reduced ABS Gravel Road Cycles; changed Milford cycle repeats Extended Grade Chatters and other WOT events; removed Lang Lang Skid Pad events. (QRD - Global Durability Test Development Team)

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