GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW15531

Passenger Vehicle Developing Road Regions General 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 global durability and reliability performance evaluation of a passenger vehicle representing vehicle usage in markets with developing road systems (e.g., Africa, South America, Russia, China).

1.2 Applicability. This 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, small sport utility vehicles (SUV) and crossover vehicles].

This test procedure is to be used to validate the Vehicle Technical Specification (VTS) requirement entitled Long-Term Requirement. See Section 3.2.3.2.4.2 of the VTS Template for additional information.

1.3 Remarks. This test procedure has been developed to reflect customer usage of markets with developing roads. These regions have less stable road systems and greater amounts of unpaved and rough roads. Other regional or local requirements may necessitate additional test options.

1.3.1 This durability test specification is intended to provide a wide spectrum of vehicle inputs in order to cause interface issues to occur. Some selected inputs are representative of 241 350 km (150 000 mi) of operation of a greater than average severity customer. Other inputs represent a much lower severity, but are included to help identify performance and durability issues throughout the life of the vehicle.

1.3.2 In addition, this test subjects a vehicle to an environment that simulates various global environmental conditions capable of promoting vehicle corrosion. Specifically, this base test provides the equivalent of five years exposure to a general corrosion environment associated with Global Regional Corrosion Classifications – Class 1 and Class 2 (refer to GMW15272 Corrosion Performance Specification). The test includes an option to run 10 years of integrated corrosion when used to support corrosion validation (refer to GMW8738 Proving Ground Corrosion Road Test Specification). If the number of required corrosion test properties has been met, then there is also an option to delete corrosion.

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

1.3.4 While GMW15531 is intended to cover “global” developing road systems, the test does not encompass all known customer usage treatments. Some of the limitations are due to accelerated usage and some are due to the constraints of the proving ground test facilities.

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

- GMW15016 Cold Weather Exposure Test
- GMW15730 Hot Weather Exposure Test

Other aspects of vehicle usage that are not sufficiently addressed in this test and should be considered during the development process include:

- Appropriate temperature aging (thermal cycling) of components – brakes, engine controls, transmission, hoses, seals, etc.
- Chemical degradation – aging, acid rain, bird droppings, ultraviolet radiation, dust exposure, etc.

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- Seat and seat restraint usage – normal wear and tear of interior passenger and cargo areas.
- Curb impacts, scuffing, or pushaways (primarily parking related).
- Non-maintenance of vehicle (lubricants, cleaning, etc.)
- Maintenance based on time periods (as opposed to mileage).
- Non-specified fluids and lubricants (lower grade materials).
- Vehicle stuck in snow, ice, sand, mud, or deep water.
- Tire chain operation (proper and improper).
- Accessory operations (windows, wipers, air conditioning, heater, etc.)

Comparable test results should be achieved by application of test vehicles on the following proving grounds according to the attached route descriptions (see Appendices A through E):

- **Cruz Alta Proving Ground (Brasil)**
  Route description see Table A1, Appendix A
- **Dudenhofen Proving Ground (Germany)**
  Route description see Table B1, Appendix B
- **Guangde Proving Ground (China)**
  Route description see Table C1, Appendix C
- **Lang Lang Proving Ground (Australia)**
  Route description see Table D1, Appendix D
- **Milford Proving Ground (USA)**
  Route description see Table E1, Appendix E

It is recognized that many test inputs and test facilities differ for the test sites included, and a continuing effort is being made to commonize some test facilities and driving maneuvers.

1.3.6 Results of this test should be regarded as highly probable to occur in the hands of some customers inasmuch as the event contains vehicle treatments based on measured customer vehicle operation. This procedure specifies vehicle operation designed to match data collected on groups of randomly selected customers' 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 test inputs.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3238	GMW15444	GMW15555	GMW15728
GMW3241	GMW15445	GMW15556	GMW15730
GMW3423	GMW15480	GMW15557	GMW16627
GMW8738 (ID)	GMW15527	GMW15669	GMW16628
GMW14264	GMW15550	GMW15677	GMW16933
GMW15016	GMW15552	GMW15708	GMW16980
GMW15216	GMW15553	GMW15709	GMW17168
GMW15272	GMW15554	GMW15715	

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2.3 Additional References.

- VTS Template – Long Term Requirement

2.3.1 Cruz Alta.

DR.CA.1060	DR.CA.1073	DR.CA.1301	DR.CA.1323
DR.CA.1061	DR.CA.1075	DR.CA.1302	DR.CA.1326
DR.CA.1062	DR.CA.1076	DR.CA.1303	DR.CA.1328
DR.CA.1063	DR.CA.1183	DR.CA.1305	DR.CA.1329
DR.CA.1064	DR.CA.1185	DR.CA.1312	DR.CA.1330
DR.CA.1066	DR.CA.1258	DR.CA.1313	DR.CA.1401
DR.CA.1070	DR.CA.1296	DR.CA.1316	DR.CA.1402
DR.CA.1071	DR.CA.1298	DR.CA.1321	
DR.CA.1072	DR.CA.1300	DR.CA.1322	

2.3.2 Dudenhofen.

DR.DH.13°	DR.DH.Ext Trip	DR.DH.Parking	DR.DH.TTE1
DR.DH.16°	DR.DH.Freeway	DR.DH.PB	DR.DH.TTG
DR.DH.ABS/TCS-Gravel	DR.DH.FS-WTBR	DR.DH.PH-1&2	DR.DH.Twist
DR.DH.Bsnubs	DR.DH.Grit	DR.DH.RA-1	DR.DH.vmax+
DR.DH.City	DR.DH.HDT	DR.DH.RC	QM AADVKA01
DR.DH.DR-1	DR.DH.Hill	DR.DH.Roll	QM AADVKA02
DR.DH.DR-2	DR.DH.IP	DR.DH.SpBmp	QM AADVKA05
DR.DH.DR-3	DR.DH.JT	DR.DH.Splash	
DR.DH.ESP	DR.DH.Mist	DR.DH.TH	

2.3.3 Guangde.

DR.GD.AI	DR.GD.EW	DR.GD.PS	DR.GD.ZB
DR.GD.AP	DR.GD.FB	DR.GD.PX	DR.GD.ZC
DR.GD.AS	DR.GD.FR	DR.GD.PY	DR.GD.ZD
DR.GD.AW	DR.GD.GT	DR.GD.PZ	DR.GD.ZE
DR.GD.AZ	DR.GD.HI	DR.GD.Q5	DR.GD.ZN
DR.GD.BR	DR.GD.IB	DR.GD.SD	DR.GD.ZO
DR.GD.BS	DR.GD.IT	DR.GD.SP	DR.GD.ZR
DR.GD.CS	DR.GD.JK	DR.GD.TD	DR.GD.ZT
DR.GD.CY	DR.GD.JT	DR.GD.TS	DR.GD.ZX
DR.GD.DB	DR.GD.MV	DR.GD.TW	DR.GD.ZY
DR.GD.DG	DR.GD.PB	DR.GD.TZ	
DR.GD.DP	DR.GD.PO	DR.GD.VW	
DR.GD.ET	DR.GD.PR	DR.GD.ZA	

2.3.4 Lang Lang.

DR.LL.1FB	DR.LL.7A	DR.LL.7PCC	DR.LL.8TC
DR.LL.1FR	DR.LL.7AR	DR.LL.7PCT	DR.LL.9AW
DR.LL.1GMC2	DR.LL.7AS	DR.LL.7S	DR.LL.BB40
DR.LL.1VM	DR.LL.7CS4	DR.LL.7SN	DR.LL.DW13
DR.LL.3RR1	DR.LL.7FBS	DR.LL.7TC3	DR.LL.DW16
DR.LL.41G0	DR.LL.7GGD	DR.LL.7TS	DR.LL.HDT
DR.LL.43G0	DR.LL.7GMC	DR.LL.8	DR.LL.OS43
DR.LL.4PER	DR.LL.7HC	DR.LL.8PT	
DR.LL.71G0	DR.LL.7JT	DR.LL.8SB	

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2.3.5 Milford.

DR.MF.AI	DR.MF.EG	DR.MF.NO	DR.MF.SG
DR.MF.AP	DR.MF.ET	DR.MF.PB	DR.MF.SL
DR.MF.AS	DR.MF.EW	DR.MF.PE	DR.MF.SP
DR.MF.AW	DR.MF.FB	DR.MF.PO	DR.MF.SS
DR.MF.AZ	DR.MF.FR	DR.MF.PR	DR.MF.TD
DR.MF.BB	DR.MF.GT	DR.MF.PX	DR.MF.TS
DR.MF.BS	DR.MF.HI	DR.MF.PY	DR.MF.TW
DR.MF.CS	DR.MF.IB	DR.MF.PZ	DR.MF.TZ
DR.MF.CY	DR.MF.IT	DR.MF.Q5	DR.MF.VW
DR.MF.DG	DR.MF.JK	DR.MF.RH	
DR.MF.DP	DR.MF.MV	DR.MF.SD	

3 Resources

3.1 Facilities. Proving Grounds used by General Motors:

- Cruz Alta Proving Ground (Brasil)
- 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. Some method of accurate speed indication should be provided to the driver for the accurate execution of the driving events. 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. See Appendix A through Appendix E.

Calendar time:	0 d
Test time:	857 h to 1653 h (proving ground dependent)
Coordination time:	0 h

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. The events that 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

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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.

4.2 Conditions.

4.2.1 Environmental Conditions. Most driving procedures can be performed in all types of weather. However, in situations where severe weather makes certain driving events unsafe they should be postponed until road conditions improve. Refer to each local proving ground driving instruction to determine if dry road conditions are required.

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.

Test vehicles equipped with automatic rain sensors for windshield wipers should have the feature turned on throughout the duration of the test.

4.2.3 Ballast. Ballast definitions are explained in GMW15445 Vehicle Ballast. The ballast calculation worksheet in Appendices A, B and C of GMW15445 should be used to determine proper ballast mass.

SUVs and vehicles with configurable cargo areas should use the cargo carrying configuration for Gross Vehicle Mass (GVM) ballast during test phases 3 and 4 of this test. Throughout test phases 1, 2, and 5, the passenger carrying configuration should be used for GVM ballast.

Sedans and coupes should use the passenger carrying configuration throughout all five phases of this test for GVM ballast.

Roof carriers are to be ballasted when at GVM during phases 3 and 4 of the test. Refer to GMW15445 for more information on roof carrier ballast. Roof carriers with cross rails are to be tested without ballast for the remainder of the test.

4.3 Instructions. Refer to the appendix for the appropriate GM proving ground (Appendices A through E).

4.3.1 Test Scheduling Guidelines.

4.3.1.1 Linear Test Content. In order to subject the vehicle to a reasonable simulation of customer usage in a linear manner of operation, distribute the event/ballast combinations as evenly as possible throughout each phase of this test.

4.3.1.2 Vehicle Break-in. The vehicle should not receive any “break-in” miles unless such are specifically required or recommended in the Owner’s Manual in such terms that more than 90% of the vehicle purchasers or users would be expected to follow the recommendation. The intention of this Durability Test is to subject the vehicle to more severe than average operation and it is believed that the omission of “break-in” miles is more severe than is their inclusion.

If the test requester determines that “break-in” mileage is required, then the “break-in” procedure should be completed prior to execution of this test procedure.

4.3.2 Driver Responsibilities. The driver is to provide the first indication that the vehicle requires attention. 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. The driver should, in essence, play the role of the customer and should initiate checkout for potential repair of the vehicle. The driver should be informed of this responsibility and should be instructed to keep accurate, thorough records on the vehicle. The driver is an important source of vehicle performance information for the test coordinator with whom they should actively communicate.

The proper execution of this durability test is highly dependent on close driver adherence to the events 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.

4.3.3 Maintenance Scheduling Guidelines. Test vehicle maintenance/repair will be based on Owner’s Manual recommendations and as closely as possible, customer maintenance/repair practices. The parking brake is expected to complete the durability test without adjustment.

4.3.3.1 Replacement Parts. The general guideline for replacement parts shall be that in those cases where a GM service part is used for 10% or more of the market, that part shall be used during this test. In those cases

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where GM's sales penetration is insignificant, the most widely used brand service part shall be used. In no case shall a part that is not or will not be available to the customer be used.

4.3.3.2 Tools. The vehicle is to be repaired and maintained with tools similar to those which would be used by a service facility working on the customer's vehicle.

4.3.3.3 Repair. Repair shall be performed when the test vehicle displays symptoms that would be detected by the customer and would be likely to prompt them to take the vehicle in for diagnosis and repair. On this basis, it is the test driver's role, as described in 4.3.2, to report that the vehicle requires attention. The driver should, in essence, be the customer, viewing and evaluating the vehicle's behavior as would the owner and recommending checkout of possible malfunction.

Repair may also be performed when, in the opinion of the responsible test user, further operation of the vehicle would prove hazardous to test personnel. In that case, a separate test involving the part or system in question is to be conducted under controlled conditions to determine all effects and results of the malfunctions such as failure mode, second and third order failures. It is essential that the communication loop be closed in cases of this nature. Any communication or information resulting from such a test is to be carefully documented and preserved.

In the event that an additional malfunction is discovered during the inspection or repair of another item, it is to be evaluated carefully before any corrections are made. Consideration should be given to the probability that the customer's mechanic would have discovered the malfunction, informed the customer, and received the authorization for repair. The test user should use supporting information defining customer practice in repairing such items.

The individual performing the repair should prepare a report documenting the operation. These reports, as well as other findings, are a major result of the overall test process and should be recorded and analyzed as data relating to test vehicle reparability and serviceability.

4.3.4 Corrosion Test Content. In order to subject the vehicle to the appropriate corrosion content, the Salt Mist and Salt Splash Road events must be distributed appropriately. The base test contains 5 years of corrosion events which must be distributed evenly throughout the first half of the general durability test. The 10 years of corrosion option events must be distributed evenly throughout the entire general durability test. Refer to GMW8738 for specific details as to the number of corrosion related events required per corrosion test year.

4.3.4.1 Vehicle Wash. Vehicle Wash events are not directly tied to corrosion years. Five car wash events are required per 10% of test with the first car wash being with the underbody option and the four additional car washes without the underbody option.

4.3.4.2 Grit Trough. Grit Trough events are not directly tied to corrosion years. Ten years of Grit Trough cycles are specified in the general durability test regardless of corrosion content. The exposure per corrosion year remains the same (refer to GMW8738).

4.3.4.3 Gravel Road Exposure. Gravel road exposure events are not directly tied to corrosion years. Ten years of gravel exposure is specified in the general durability test regardless of corrosion content. The exposure per corrosion year remains the same (refer to GMW8738).

4.3.5 Optional Events. Optional test content can be run in conjunction with the core test content to meet specific regional needs.

4.3.5.1 Selectable All Wheel Drive. For vehicles with selectable all-wheel drive (AWD), the AWD option is to be used one driving shift per day.

4.3.5.2 Other Available Test Additions. The Spare Tire and Jack/Tire Inflator each provide exposure that can be expected in the customer environment and may provide valuable information.

Additionally, a Corrosion Delete selection and a 10 Year Corrosion Addition are available.

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