



Static and Dynamic Test of Cargo Compartment Load Floors and Sill Plates

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 test procedure is to determine deflection and durability of the spare wheel/tool compartment cover and other shelves under static and dynamic loads.

1.2 Applicability. This specification is applicable to all covers, load floors, and shelves in installed condition for sedan, convertible, hatchback, SUV, station wagon load floors and sedan sill plates.

1.3 Remarks. All tests shall be performed with all released installation components.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3059

GMW14093

GMW14444

2.3 Additional References.

- Best Practice RCOMPTR-6 (Rear Compartment (Trunk) Trim to Decklid Seal Interface). The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.
- Best Practice RCOMPTR-9 (Global Trunk Trim Sill Plate Flipper Panel Door Assembly, Potato Chip Cover and Non-cover Execution Guidelines for Notchback/Passenger Car Vehicles). The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.
- Computer Aided Engineering (CAE) Standard Work, Load Floor Analysis, (link to document is located in the Interior Focus Group Site at the following link, <https://gmweb.gm.com/sites/InteriorFocusGroup/Pages/ISW.aspx>), under the Procedure Number 40-01-028 (document link to the Global Document Management system is as follows, <https://documents.gm.com/gdm3/drl/objectId/090163bc81702883/chronicleId/090163bc81702883/format/msw8>). The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.
- Global Decklid Subsystem Technical Specification.
- Statement of Requirements (SOR) Appendix C1, Seat Subsystem Technical Specification.

3 Test Preparation and Evaluation

3.1 Resources.

3.1.1 Facilities. Milford Proving Ground, Dudenhofen Proving Ground containing tracks referenced in Section 4, or equivalent.

3.1.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

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3.1.1.2 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.

3.1.2 Equipment.

3.1.2.1 Adjustable measuring linkage.

3.1.2.2 Base plate/load application plate 300 mm x 300 mm.

3.1.2.3 Base plate/load application plate with a diameter of 80 mm and with a rubber stamp in the plate surface with a minimum thickness of 5 mm and durometer hardness < 60 (Shore).

3.1.2.4 Measuring tape.

3.1.2.5 Straight rod (e.g., made of aluminum or wood) ≥ 600 mm x 30 mm x 4 mm.

3.1.2.6 The test weight shall be the maximum authorized vehicle payload (rear axle load).

3.1.2.7 Tie-down ropes/belts.

3.1.2.8 Sand bags preferably 20 kg each.

3.1.3 Test Vehicle/Test Piece.

3.1.3.1 Load Surface and Measuring Points. The load application plate/base will be placed centrally with reference to the supporting distance ≥ 400 mm. Deflection is measured in the center of the loaded surface.

With supporting distances < 400 mm an edge of the base plate is placed 50 mm from a supporting edge. Deformation is measured at this edge.

3.1.3.2 The preferable hardware for static tests is to use a test buck, but when not available, they can run in a test fixture. For dynamic tests, a full vehicle is required.

3.1.4 Test Time. Not applicable.

3.1.5 Test Required Information.

3.1.5.1 Maximum Loads. If not otherwise defined within the scope of the project, the basic assumption is that the load floors and shelves are capable of the maximum authorized payload. Consequently, the $F_{\max}$ is defined as the maximum allowed payload on the rear axle. Thus,

$$F_{\max} = \text{Maximum axle load} - \text{Curb mass rear axle}$$

Otherwise, the program Mass Engineer and/or Chassis Design Release Engineer/System Validation Engineer (DRE/SVE) shall be able to provide the payload rear axle data.

3.1.5.2 If the load compartment is provided with tie-down rings for securing the cargo, load floor stress will be increased if the tie-down rings are used. In such a case, the force $F_{\max}$ shall be multiplied by factor 0.2 and considered for testing with tie-down rings. Refer to Distributed Load Test according to 4.3.1.

3.1.6 Personnel/Skills. Not applicable.

3.2 Preparation. The test sample shall be allowed to soak at the appropriate temperature for 2 h prior to the test.

3.3 Conditions.

3.3.1 Environmental Conditions.

3.3.2 Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, program SOR, etc.

Tests that are to be performed "at temperature" (i.e., cold and hot) are to be conducted in the environmental chamber after an appropriate minimum soak time has been reached (refer to specific procedures for soak requirements). The tests are to be performed in the chamber at the temperature specified. Parts to be tested are not to be soaked and subsequently removed from the chamber for the duration of the test, (i.e., soaking the parts in the chamber and bringing them into an ambient temperature lab for the duration of the test is not permissible under this specification). If not otherwise stated, the tests on each part shall be conducted in the temperature order shown in Table 1.

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Table 1: Test Conditions

1	Thermal soak for 1 h at +80 ± 3 °C.
2	Conduct test at +80 ± 3 °C and record results.
3	Thermal soak for at least 1 h at +23 ± 3 °C.
4	Thermal soak for 1 h at -30 ± 3 °C.
5	Conduct test at -30 ± 3 °C and record results.
6	Thermal soak for at least 1 h at +23 ± 3 °C.
7	Conduct test at +23 ± 3 °C and record results.

3.3.3 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.

3.4 Instructions. Not applicable.

3.5 Data. Not applicable.

3.6 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.

3.7 Documentation. Samples of components or material released to this standard shall be tested for conformity with the requirements of this standard and approved by the responsible GM Department prior to the start of delivery of production level components or materials.

Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture requires a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release.

If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases, a shorter test can be agreed to between the responsible GM department and the supplier.

3.7.1 Test Results. The results of the testing shall be presented in a GM Evaluation Test Report along with pictures of the testing.

4 Requirements and Procedure

4.1 Static Test (Europe-27 Only). This test shall only be conducted if the vehicle is sold in Europe-27. The purpose of this test is to determine the deflection under static load. The static load is $\frac{1}{3}$ of the maximum authorized payload (axle load).

$$F_{\text{stat}} = \frac{1}{3} F_{\text{max}}$$

F_{max} = Maximum axle load - Curb mass rear axle

4.1.1 Static Test - Performance. For this test, the 300 mm x 300 mm base plate will be used. The test sample shall be placed in the original body, or an appropriate underbody in installed position. The base plate shall be placed as described in 3.1.3.

4.1.1.1 The deformation zero-measurement is made with a load of 100 N applied to the base plate.

4.1.1.2 Immediately after this the total weight F_{stat} is applied to the sample (on the squared plate as shown in Figure 1), 100 N is included in the total weight.

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Figure 1: Load Application Using a Test Buck



4.1.1.3 After 5 minutes of load application the deflection (elastic deformation) shall be measured in the weakest area or in the points defined by the Subsystem Validation Engineer and Design Release Engineer.

4.1.1.4 The weight is now removed except for the basic load.

4.1.1.5 After a further 5 minutes the permanent (plastic) deformation shall be measured.

4.2 Dynamic Test. The purpose of this test is to determine the deflection under dynamic load conditions.

The dynamic test shall be made at the maximum authorized load F_{dyn} . For this the 20 kg sandbags shall be evenly placed on the sample to be tested.

$$F_{dyn} = F_{max}$$

Dyn	Dynamic
Max	Maximum

The number of sandbags is limited by the requirement that it shall be possible to close all doors and the tailgate (in the case of an SUV, from the load floor to the headliner).

If the specified load cannot be applied, the load applied shall be documented as the test load.

4.2.1 Test on the Belgian Block Track. Before the test, check the test sample evenness using a straight rod. Uneven areas shall be recorded. The test load shall be placed and secured with tie-down belts. Subsequently, the following tracks shall be used:

- Torture Track (20 times).
- Belgian Block 0.3 km with speed 30 km/h.
- Chuckholes 0.3 km with speed 35 km/h.
- Hump track 0.3 km with speed 35 km/h.

(e.g., on the Dudenhofen Proving Ground, Milford Proving Ground).

4.2.1.1 The total weight F_{max} shall be removed.

4.2.1.2 After a recovery time of 15 minutes, the straight rod shall be placed diagonally in the obviously most unfavorable location for measurement of the permanent set.

4.2.2 Curb Test. Before the test, check the test sample evenness using a straight rod. Uneven areas shall be recorded. The test ballast shall be placed and secured with tie-down belts. Subsequently, drive off a 100 mm high curb (i.e., sidewalk) at a right angle in forward direction 10 times as shown in Figure 2. The test shall be performed at a vehicle speed of 5 km/h maximum.

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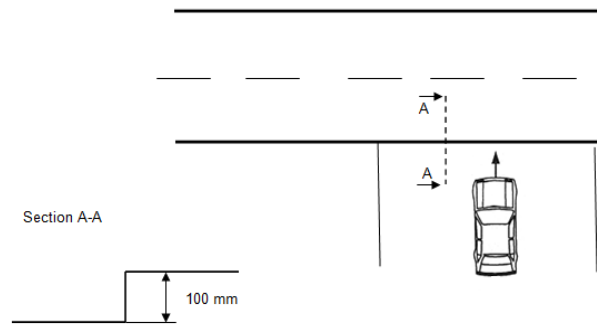
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Figure 2: Curb Test Diagram

**4.2.2.1** Remove total weight.

4.2.2.2 After a recovery time of 15 minutes, the straight rod shall be placed diagonally in the obviously most unfavorable location for measurement of permanent set.

4.3 Abuse Test. The purpose of the abuse test is to check whether or not the parts are capable of carrying the specified loads. When driving the vehicle, vertical accelerations of up to 5G will occur. For the calculation of the maximum load, accelerations of up to 2.5G shall be considered. The 20 kg sandbags shall be evenly placed on the sample to be tested. The requirements for this Dynamic Abuse Test are described as follows.

- Failure of the parts as a result of the test is not allowed.
- Failure is defined as cracks and buckles jeopardizing full function of the parts.
- Even without destruction, no obvious permanent deformation is allowed after removal of the load.

4.3.1 Distributed Load Test. This test is applicable to all vehicle configurations (e.g., SUVs, Sedans, Hatchbacks, Notchbacks, and Station Wagons). All parts shall be in nominal design vehicular position (e.g., seats not folded).

A standard distributed load of 180 kg is applied all along the trunk load area, this includes but it is not limited to load floor extensions (soft trim or plastic trim), battery covers, closeout panels, rails. For any concern, contact the Trunk Trim Bill of Material (BOM) Family Owner (BFO) and/or Trunk Trim Validation Technical Integration Engineer (TIE)

An alternative method for the Distributed Load Test to calculate the Distributed Load in the Trunk Trim area (mainly for programs sold in Europe) is as shown as follows:

$$F_{Mstat.} = (F_{dyn} \times 0.2 \text{ (if tie-downs available)}) + (F_{dyn} \times 2.5)$$

In some cases, when using a test buck or vehicle, $F_{Mstat.}$ calculation may be affected or limited by the volume capacity in the rear compartment. If this is the case, test the load floor separately with all its supporting components. A picture using a test buck is shown at Figure 3.

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