



Repetitive Shock for Door Trim - Simulated Door Slams

1 Scope

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 Repetitive Shock for Door Trim – Simulated Door Slams durability test, is a “Time Accelerated” success based test for door trim components that will enable rapid reliability assessment and facilitate quick learning cycles. The repetitive shock test is a subsystem level test, which uses only the door system (as opposed to the traditional Body Slam Test which requires the entire body). This test can be used either as a validation test to replace the traditional door slam test or can be used earlier in the design process as a developmental test to uncover failure modes through quick learning cycles.

1.2 Foreword. The repetitive shock test is a Dynamic test to uncover failure modes on door trim which is due to dynamic input as follows:

1.2.1 Fastener durability (fasteners coming loose).

1.2.2 Door trim structural integrity (cracking, etc.)

1.2.3 Snap fit joint (detachment, broken, etc.)

1.2.3.1 Dog house cracking.

1.2.3.2 Two adjacent broken birds’ beaks (loss of integrity).

1.2.3.3 Switch plate or other attached trim that deflects more than 1.5 mm with a 10 N force applied.

1.2.3.4 Detached speakers.

Note: This test does not uncover failures due to quasi-static pull effects including pull handle durability/fatigue.

1.3 Applicability. This repetitive shock test is a subsystem level test and utilizes the door system.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References.

CG190- GM Approved Test Report Form

Front and Rear Side Door Global Subsystem Technical Specification (GSSTS)

3 Resources

3.1 Facilities. An International Organization for Standardization (ISO) or equivalent certified laboratory.

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 A test plate and hydraulic/pneumatic system capable of inducing a 39 J input to the part.

3.2.2 An environmental chamber capable of housing the test apparatus and maintaining the temperature extremes as shown in the profile.

3.2.3 Three (3) accelerometers with the capability to provide accelerations versus time plots.

3.3 Test Vehicle/Test Piece. The repetitive shock test involves testing only the door on a vertical input table. The test utilizes a built up door hardware with the appropriate trim, the entire body is not required.

Typically, the material required for this testing is as described below:

- Fully Dressed Door Metal-Painted and Baked (door will need to be mass representative including speakers and all hardware, i.e., lock rod, outside handle, wire harnesses, door side hinge, as well as window glass and trim)
- Fully Dressed Door Trim (All Part of Assembly (POA) electrical content including door trim wiring harness)
- Handle Brackets
- All Fasteners (screws, birds' beaks)
- Shark Fin
- Screw Covers
- Heaviest Switch Plate, Bezel, and All Clips
- Build Instructions with Torques
- Before Shipping Inspect Trim for Good Heat Stakes
- Speaker Grilles (if separately applied)
- Latches
- Inside Release Handle (ISRH)
- Push Nuts and J Nuts for metal
- Belt Line Seal, Window Regulators, Window Crank, Lock Knobs, Appliques

Note: It is recommended that the tested sample is the most content and highest mass version. If Left Hand (LH) and Right Hand (RH) door trim are not mirror parts, both need to be tested.

3.3.1 See Appendix A: Test Sampling and Fixturing. For best results, it is suggested that the door be completely built up. This includes the door hardware with window glass and other components such as speakers, switches, switch plates, etc., as described above or a mass representative of the component. This will simulate the actual inertia of the door and will be more representative of the actual slam vibration conditions. The number of samples required is based on the reliability requirements. For R95C50, the required reliability and confidence interval, it is recommended to test three samples to four lives each or when failure occurs. However, the number of samples should be determined by the appropriate GM engineer.

3.4 Test Time.

Calendar time: 22 days

Test hours: 60 hours

Coordination hours: 7 hours

Note: The 22 days are by door trim design (three samples, four lives). To validate the full set (car set) of door trims (front and rear) would take approximately 42 days (assuming that the left hand and right hand door trims are identical), depending on the test lab. When there is a different design (for instance driver side having pull cup and passenger side having grab handle), both designs need to be tested and the test time will be longer.

3.5 Test Required Information. Reference profile for test.

3.6 Personnel/Skills. The following individuals are necessary to complete this test procedure:

3.6.1 General Motors Design Release Engineer.

3.6.2 General Motors Validation Engineer.

3.6.3 Testing Organization's Test Engineer.

3.6.4 Testing Organization's Test Technician.

3.6.5 Testing Organization's Computer Aided Engineering (CAE) Engineer

4 Procedure

4.1 Preparation.

4.1.1 Mount the test specimen onto the test plate and rigidly affix.

4.1.2 Obtain the acceleration profile for the door trim on an on body condition using the same inputs suggested in the Door Slam Test. If an acceleration profile is not available, use a standard acceleration profile (maintained by the body test lab) for similar type doors as a reference.

4.1.3 The door is mounted horizontally on a shaker table as illustrated in Appendix A, Figure A1. Since the goal of the accelerated test is to simulate the same acceleration conditions on the door using a shaker table, accelerometers are mounted in specific locations as agreed to by the design release engineer and the test engineer. These locations are typically at the latch and the hinge area. An accelerometer also placed on the center of the door trim is useful in calibrating the table.

4.1.4 One (1) acceleration input per second will allow the trim to stop reverberation before the next cycle. Refer to Appendix B.

4.2 Conditions.

4.2.1 Environmental Conditions. Conduct the test operating as shown in 4.3. There is no soak time required to start the sequence, the cycles are started after the chamber environment has reached the temperature and humidity levels as stated in 4.3.

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.

4.3 Instructions.

4.3.1 Set the frequency of the input as described in the input profile (Appendix B).

4.3.2 Set the input in the shaker table to 10G, 10 ms (a representative starting input profile).

4.3.3 Measure the response from the accelerometers and correlate with reference profile. This will usually produce 24G on the trim. Typically, the reference profile is obtained by putting three accelerometers in three different locations (traditionally at the latch area, lower edge of the door and in the center of the pull cup or grab handle) as shown in Appendix A, Figure A2. (See also Section 7).

4.3.4 If the response profile and the reference profile match, then you have determined the input profile.

4.3.5 If the response does not match, then adjust the input until the representative response is achieved.

4.3.6 Run the test using input profiles to the number of cycles specified in the Front and Rear Side Door GSSTS - refer to the Front and Rear Door Slam Durability Cycle Definition Section, otherwise, use the cycles defined by the requesting engineer.

4.3.7 Use profile below to determine relative number of hot/humid cycles.

4.3.8 Continue test to failure or for a maximum of 4 life cycles.

4.3.9 Inspect samples and log observations at initial start of test and each subsequent temperature phase. Failure modes are identified below:

4.3.9.1 Fastener durability (fasteners coming loose).

4.3.9.2 Door trim structural integrity (cracking, etc.)

4.3.9.3 Snap fit joint (detachment, broken, etc.)

4.3.9.3.1 Dog house cracking.

4.3.9.3.2 Two (2) broken adjacent birds' beaks (loss of integrity).

4.3.9.3.3 Switch plate or other attached trim that deflects more than 1.5 mm with a 10 N force applied.

4.3.9.3.4 Detached speakers.