



Door Sliding Side System (Manual) - Slam Durability

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. To determine the door slam durability of vehicle sliding side door systems and related components and subsystems.

1.2 Foreword. Typically, rodless pneumatic cylinders have been used for cycling the sliding door. Experience has shown that it is less cumbersome to use the rodless cylinders.

1.3 Applicability. This procedure directly applies to all passenger cars, light duty trucks, and medium duty trucks with manual sliding side doors. It indirectly applies to power sliding door systems.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW15938

2.3 Additional References.

- CG190
- Release Documentation. This includes: Master Process Documents (MPD), Local Process Plans (LPP), etc., which show any product assembly, orientation, fit, assembly specifications, etc., for the system being evaluated.
- Subsystem Technical Specification (SSTS).
- Vehicle Technical Specification (VTS).

3 Resources

3.1 Facilities. A laboratory providing the equipment listed in Section 3.2 is able to provide the conditions listed in Section 4.2.

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 scribe or paint pen.

3.2.2 Torque wrench(s) with a capacity of approximately 1.5x each fastener torque.

3.2.3 The following lists include fixturing and instrumentation typically used to perform this test. Other equipment may be substituted at the discretion of the testing facility as long as it provides the same data and/or data record, with equivalent accuracy as specified herein or by the requestor.

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3.2.3.1 Fixturing.

3.2.3.1.1 A box frame structure to mount a linear actuator (Figure A1).

3.2.3.1.2 An actuator with travel sufficient to move the sliding side door from a fully closed to a fully opened position (Figures A1 and A2) according to performance checks referenced in Section 3.5.1. A rodless linear actuator has typically been used for cycling the door.

3.2.3.1.3 Actuators capable of cycling the required components. Some potential components are inside and outside door handles, key cylinders, and child security locks. Actuators should be of sufficient capacity and stroke for operating each component that will be required to be actuated during the test as referenced in Section 3.5.1.

3.2.3.2 Instrumentation.

3.2.3.2.1 A sliding side door controller capable of reproducing the performance objectives referenced in Section 3.5.1.

3.2.3.2.1.1 The sliding door controller should have a feedback controller that is able to adjust the pressure of the linear actuator.

3.2.3.2.1.2 When the feedback controller adjusts the pressure of the linear actuator, the door velocity is adjusted to meet certain velocity targets when opening and closing the door.

3.2.3.2.1.3 The pressures required to get the door moving may be higher than those required for opening and closing the door at the target velocity. Because of these cases the controller should be able to offer a two stage control.

3.2.3.2.1.3.1 The first stage is at a high enough pressure to get the door in motion.

3.2.3.2.1.3.2 The second (lower) stage is where the pressure is enough to meet the target opening or closing velocity.

3.2.3.2.2 An optical micro-switch (velocity gate) capable of determining door velocity, with appropriate feedback to the sliding side door console (Figure A5).

3.3 Test Vehicle/Test Piece. Additional information on test required material and its assembly can be found in the Release Documentation (see 2.3).

Note: It is recommended that the test parts/assembly be dimensionally certified before testing is started.

3.3.1 One (1) vehicle or body with all representative hardware, trim and weather strips present on the sliding door opening.

3.3.2 One (1) fully assembled, painted, trimmed, heat cured, sliding side door. Discuss with the requesting engineer if mass should be added to the door inner panel to represent missing trim or other attachments.

3.4 Test Time.

Calendar time: 70 days

Engineer hours: 56 hours

Technician hours: 20 hours

3.5 Test Required Information. The requesting engineer is responsible for providing specifications appropriate to the particular vehicle line being tested (2.3).

Testing worst case scenarios may uncover some potential problems. Discuss with the requesting engineer if testing should include worst case scenarios. Depending on which test is being performed and which level of parts or systems is being tested, consider if any of the following may apply:

- Tolerance stack-ups.
- Build variations.
- Misalignment.
- Minimum/maximum fastener torque(s).
- Lubrication.
- Environmental extremes.
- Location of customer representative load application.

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- Symmetry (Left Hand vs. Right Hand).
- Color.
- Mold or die source, etc.

3.5.1 The following specifications or information are required to run this test. These specifications can be found in the vehicle Subsystem Technical Specifications (SSTS).

3.5.1.1 Door slam velocities/door opening velocities.

3.5.1.2 Location(s) of door slam velocity measurement(s) relative to the door open/closed position.

3.5.1.3 Window position(s) during door slams.

3.5.1.4 Environmental temperature and humidity.

3.5.1.5 Door slam/opening cycling sequence.

3.5.1.6 All applicable fastener torque values.

3.5.1.7 Gap/flushness requirements.

3.5.1.8 Operating effort requirements.

3.6 Personnel/Skills. Prior experience in setting up and running similar tests, and experience in the use of the referenced test equipment is critical to achieving the estimated times shown in 3.4.

4 Procedure

4.1 Preparation.

4.1.1 Sample Inspection. The test and requesting engineers should inspect the test items to insure all material listed in 3.3 is of correct design level and assembled properly.

4.1.1.1 Verify that all door components are functioning properly.

4.1.1.1.1. Note and record areas of visible metal deformation, hem separation, cracks, weld failures, or interference between door components.

4.1.1.1.2 The requesting engineer should be notified if these conditions exist and determine if those components should be replaced before cycling begins.

4.1.1.1.3 All discussions and decisions should be documented before cycling begins.

4.1.1.2 Ideally, the door system will be ready for testing when it is received. It is usually required that the door and body opening assembly meet all of the gap and flushness requirements before testing is started.

4.1.1.2.1 Note and record the dimensions between the door and body opening as defined in GMW15938.

4.1.1.2.2 If the door does not meet the criteria of GMW15938, the requesting engineer should be notified.

4.1.1.2.3 If specific directions are not given, then the door system should be modified to meet the gap and flushness requirements established in the Vehicle Technical Specifications (VTS).

4.1.2 Sample Preparation. This test is normally run on the test subject in an **as received** condition. If it is requested to be run in a specifically adjusted condition, follow the applicable procedure(s).

4.1.2.1 If a change to the door includes removing some components of the door and specific directions are not given, then the change should be done following the steps given in the Master Process Documents (MPD).

4.1.2.2 In order to detect movement or separation of the hem flange, a scribe or paint pen should be used to make a reference mark along the hem flange.

4.1.2.3 In order to detect movement of the fasteners, a straight line should be made from the center of the fastener head to the panel or component that the fastener connects to. A scribe or a paint pen can be used to make this mark.

4.1.3 Facilities/Equipment Preparation. Record the instrumentation calibration information on Data Sheet A1 or an equivalent document.

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 Unless otherwise specified in this document or by the requesting engineer, the typical environmental conditions for this test are the temperature, humidity and pressure at the test facility.

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4.2.1.2 Unless otherwise noted, these conditions are typically $22\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$, relative humidity of $40\% \pm 20\%$, and atmospheric pressure equivalent to the local barometric pressure, which is variable during any given day.

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 Setup Instructions.

4.3.1.1 Perform any functional/operational tests/evaluations as requested or as may be referenced in Section 3.5.1.

4.3.1.2 Cycle the door system through at least five full cycles to ensure proper operation and seating of all system components.

4.3.1.3 Note any irregular sounds or erratic operation indicating a potential problem with design, manufacture or assembly and verify observations with the requesting engineer.

4.3.1.4 Perform all pre-test functional checks as required by the SSTs.

4.3.1.5 Perform a pre-test inspection of the system by cycling the door slowly by hand to check for interference during the door travel.

4.3.1.6 Program the controller to perform the number of slam cycles required until first inspection. The number of slam cycles will be defined in the SSTs.

4.3.1.7 Set actuator air pressures to a **low** setting to avoid damage during initial cycling.

4.3.1.8 Slowly increase air pressures to attain required velocities.

4.3.1.8.1 This procedure can be performed with linear actuators mounted inside and/or outside the body.

4.3.1.8.2 Steps 4.3.1.7 thru 4.3.1.14 should be modified to accommodate the particular actuator mounting location used.

4.3.1.9 If the linear actuator is mounted inside the vehicle, remove the seats as necessary to allow for installation of the box frame.

4.3.1.10 If testing a full suspension vehicle, do not restrict the natural springing reactions of the tires or suspension. This better represents the energy absorption characteristics of the sliding door during slamming.

4.3.1.11 Install the box frame structure (Figure A1) to the vehicle's floor pan.

4.3.1.12 Fasten the linear actuator to the box frame at the height of the release handle on the sliding door. The actuator should be horizontal and parallel to the travel of the door (Figure A2).

4.3.1.13 Attach the adapter (preferably a loop of seatbelt webbing or equivalent) to the release handle (Figure A3).

4.3.1.13.1 Allow enough length in the loop so that the door is allowed to move inboard/outboard as necessary during cycling.

4.3.1.13.2 The loop should be taut in the full open position, and slack in the closed position.

4.3.1.13.3 Insure that the linear actuator travels far enough to allow the door to open and close fully.

4.3.1.13.4 Position the actuator as close as possible to the door so that inboard loading (pulling) of the door handle is minimized.

Note: Some handle designs will not allow handle release and door travel to be accomplished with the same actuator. If this is the case, an additional outside door handle actuator and adapter may be required to unlatch the door (Figure A4). The handle actuator should be mounted so that it approximates the location that a passenger would grasp when entering the vehicle. A similar setup can be used on the inside handle if inside handle cycling is preferred or requested.

4.3.1.14 Door velocity flags should be mounted onto the outer panel of the door as shown in Figure A5. Sheet metal screws are often used. An alternative method to mount the velocity flags is to use double sided tape.

4.3.1.15 The velocity gate should be mounted as shown in Figure A5. The gate can be attached by clamping a rod to the pinch flange of the vehicle under test.

4.3.1.16 The entire width of each flag must pass completely through the velocity gate as the door cycles.

4.3.1.16.1 The flag blade must not contact any part of the velocity sensor.

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