



Door Sliding Side System (Off Body) Vertical Rigidity Structural Test

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 deflection and plastic deformation characteristics of a sliding side door system when subjected to vertical loads applied at the latches.

1.2 Foreword. A sliding side door is secured in body position to a rigid fixture. Next, vertical load is applied at the front latch and then at the rear latch. Deflection and set deflection readings in the vertical direction are measured at the latch just below the latch opening or at another specified location.

Note: GMW15941 performs the same evaluation for this door system when mounted on a body.

1.3 Applicability. This procedure applies to all passenger cars and light duty trucks having sliding side 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.

None

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 Specifications (SSTS)
- Vehicle Technical Specifications (VTS)

3 Resources

3.1 Facilities.

- **Major Facility:** A laboratory providing the equipment listed in 3.2 and able to provide the conditions listed in 4.2.
- **Minor Facility:** Structural surface plate or bed plate.

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.

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3.2 Equipment. The following list(s) 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.

3.2.1 Fixturing.

3.2.1.1 Rigid stanchion, with associated tie-down clamps, to provide mounting for the servo linear actuator (Figure A1).

3.2.1.2 Attachments to connect the load cell to the servo linear actuator and to the load application fixturing.

3.2.1.3 Vertical rigidity load bar and stanchion assembly that enables the door to be loaded in the vertical direction (Figure A1). The load bar typically used has a 2:1 leverage ratio.

3.2.1.4 Rigid stanchions with appropriate clamps to hold the door by its hem flanges in body position.

3.2.1.5 Roller bracket mounting plate assemblies for the sliding door upper track, center track, and lower track sections (Figures A2 thru A4). A drawing to show the upper track, center track, and lower track section may be required to construct the roller bracket mounting plates.

3.2.1.6 Rigid stanchions for mounting the door by its roller brackets, in body position. The roller bracket mounting plate assemblies are attached to these fixtures.

3.2.1.7 Clamps and metal blocks to keep the center and upper roller brackets from moving in the roller bracket mounting plate assemblies (Figures A3 and A4).

3.2.1.8 Fixturing to position the displacement transducer near the front or rear latch (Figures A5 and A6).

3.2.1.9 Miscellaneous stanchions, tie down hardware, etc., to mount and secure test equipment to the surface plate.

3.2.2 Instrumentation.

3.2.2.1 Signal conditioners, a servo linear actuator controller, data acquisition, a computer and software that are used to generate a load vs. displacement plot.

3.2.2.2 Load cell with a capacity of approximately 1.5 times the maximum specified load.

3.2.2.3 Servo linear actuator.

3.2.2.4 Displacement transducer (Figure A5).

3.2.2.5 Torque wrench(es) with a capacity of approximately 1.5 times the fastener(s) required torque specification(s).

3.2.2.6 Ultrasonic thickness tester (for measuring metal panel thickness) or caliper (if testing non-metallic parts).

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).

3.3.1 Test Material. Test material is a **Door In White (DIW)** that has been through the production paint and bake process. The DIW includes roller bracket assemblies, latches, strikers, and fixed glass.

The side glass provides no additional structural strength to the door. Therefore, it is not required for this test.

3.3.2 Test Material Recommendations.

3.3.2.1 It is recommended that new roller bracket assemblies be obtained for each latch tested due to possible bending of the brackets during testing.

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

3.4 Test Time. The following is an estimate of the amount of time (work hours) needed to perform this procedure.

Note: These time estimates are approximate averages. Actual times vary considerably depending on early component failures (and subsequent availability of replacement parts), testing to varying multiples of cycle lives, varying requirements for frequency of environmental test conditions, scheduling problems for test facilities, test equipment malfunctions, scheduling of overtime and/or multiple shifts, scheduling of **witnesses** for tests, actual readiness of test samples upon receipt, unique or additional requests for detailed test information, running multiple samples. Times shown are for one system, etc.

These times consider preparation and other downtime, actual test, and analysis of data in capturing a total calendar time. Report writing, approval, processing, etc. are not part of these times.

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Calendar time:	1 day
Engineer hours:	4 hours
Technician hours:	8 hours

3.5 Test Required Information. The requesting engineer is responsible for providing specifications appropriate to the particular vehicle line being tested. Discuss with the requesting engineer the VTS/SSTS paragraph numbers, if applicable (2.3).

3.5.1 The following information is required to run this test:

3.5.1.1 Load magnitude(s), orientation of load direction(s) (up/down) and sequence of loading.

3.5.1.2 Location of load application.

3.5.1.3 Location of deflection and set deflection measurements.

3.5.1.4 Maximum deflection and/or set deflection specifications.

3.5.1.5 Any critical part thickness and measurement locations.

3.5.1.6 All applicable fastener torques.

3.5.2 Worst Case Scenarios. Testing worst case scenarios may uncover some potential problems. Discuss with the requesting engineer if testing should include some 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
- Symmetry (Left hand vs. Right hand)
- Color
- Mold or die source

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

4 Procedure

4.1 Preparation.

4.1.1 Sample Inspection.

4.1.1.1 The test and requesting engineers should inspect the test items to insure all material is of correct design level and assembled properly. Check the door assembly for bent track sections, bent roller brackets, and for any damage to the rollers.

4.1.1.2 If instructed to do so, use the ultrasonic thickness tester or other suitable measuring tool (i.e., caliper for non-metal doors) to measure critical part thickness in the areas specified by the requesting engineer.

The locations chosen for thickness measurement should be chosen because they are significant contributors to the door structural performance. Be aware that drawn (stretched) sheet metal sections may be significantly thinner than flat sections of the same part.

Verify thickness measurements with the requesting engineer before beginning the test set up; if parts were made from the wrong stock, or are out of specification, it may be worthwhile to postpone the test until they are corrected.

Note: For the most accurate thickness measurements, carefully remove paint, primer, etc. where the thickness measurements will be recorded. Be sure to use non-destructive or non-abrasive means (such as a liquid paint

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remover) so the thickness of the part being measured is not altered. Do not attempt to remove any plated coatings (e.g., galvanizing).

4.1.1.3 Note any areas of metal deformation or irregularities before performing the test. This may aid in analyzing test results. Discuss any of these observations with the requesting engineer prior to testing.

4.1.1.4 If the doors have not been through the Electrophoretic Priming Operation (ELPO) system, then they must be **baked** before testing in order to fully **cure** the adhesives in the hem, door beam, etc.

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).

4.1.3 Facilities and/or Equipment Preparation. Record the instrumentation calibration information on Data Sheet B1 or an equivalent document.

4.2 Conditions.

4.2.1 Environmental Conditions. 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 major test facility (3.1). Unless otherwise noted, these conditions are typically 22 °C + 3 °C, relative humidity of 40% + 20%, and atmospheric pressure equivalent to the local barometric pressure. Local barometric pressure is variable during any given day and from day to 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. Unless this test is being performed on a competitive vehicle, analysis data should be available for the test being performed. For correlation purposes, communication between test and analysis personnel must take place to ensure that the loading conditions, restraints, and measurement locations are consistent between the test and analysis procedures.

4.3.1 Setup Instructions.

4.3.1.1 Mount the door to rigid stanchions in approximate body position by clamping it along the front and rear vertical hem flanges.

4.3.1.2 Align the stanchions with the roller bracket mounting plate assemblies to the door's roller bracket assemblies. Slide the end of the door's roller bracket assembly into the track on the roller bracket mounting plate track. Scribe or otherwise mark the position of the roller bracket assemblies relative to the door and fixture. If applicable, also scribe along the door's hem line. This scribing is done to help detect any movement of the hem or roller bracket assemblies that may occur during testing.

4.3.1.3 Place a metal block in the track in front of the lower roller bracket. Clamp the block in place to restrict forward movement of the roller bracket during testing (Figure A3).

4.3.1.4 Place a metal block in the track rearward of the center roller bracket. Clamp the block in place to restrict rearward movement of the roller bracket during testing. The upper roller bracket is not restrained in the track since the lower and center brackets restrain forward and rearward movement of the door during testing.

4.3.1.5 Remove the clamps and the rigid stanchions that are clamping the front and rear vertical hem flanges.

4.3.1.6 Adjust the vertical rigidity load bar so it is parallel to the door's front latch face (Figures A5 and A6).

4.3.1.7 Adjust the load bar up or down on the stanchion so that it is horizontal when the striker is fully engaged into the latch. Fully engage the striker into the door latch.

4.3.1.8 Position and secure the displacement transducer or an equivalent measuring device to measure the vertical door movement at the latch as specified in 3.5.1.3. Describe, in accurate terms or body coordinates, the position where the vertical deflection is measured.

4.3.1.9 Position the servo linear actuator so that its shaft is vertical and in the mid travel position. Make any further alignments and connect the load bar to the load cell, using fasteners that allow sufficient free play so no preload will be applied as the fixtures are clamped down. Clamp the load cell fixture and the load bar stanchion to the structure plate.

4.3.1.10 Calibrate and zero the displacement measuring instrument and the load cell.

4.3.2 Test Operation Instructions.

4.3.2.1 Use an X-Y plotter to create a grid similar to the one shown in Figure A7 or an equivalent graph.

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4.3.2.2 Apply the load(s) specified by the requesting engineer (servo motor ram travel rate is to be 1 mm/s), while also graphing the load vs. the door's vertical deflection with the X-Y plotter. After the specified load value is reached, change the motor direction and release the load back to zero. Do not change the ram travel rate when releasing the load. Refer to sample plots Figures A8 and A9 for assistance in interpreting possible problems that may occur during testing.

It is the responsibility of the requesting engineer to determine if the door will receive loads in both the up and down directions and if multiple loads will be applied to the same door. Unless otherwise stated, it is standard to load the door 900 N down.

4.3.2.3 Disconnect the actuator from the load bar.

4.3.2.4 Check the door assembly for any damage that occurred as a result of testing.

4.3.2.5 Test the rear latch by following steps 4.3.1.6 thru 4.3.2.4. In step 4.3.1.6 the vertical rigidity load bar should be adjusted so it is parallel to the door's rear latch face.

4.3.3 Posttest Instructions. Every posttest operation/measurement/inspection must typically have a pretest equivalent to have any meaning or significance. A crack detected at end of test means nothing unless there is pretest documentation verifying no crack existed prior to start of test.

Check the door assembly for bent tracks or roller brackets and for any damage to the rollers.

Note: These discrepancies on the data sheet and discuss with requesting engineer about possible actions.

5 Data

5.1 Calculations.

5.1.1 From the load vs. displacement plots, determine the deflection at the specified load and the amount of permanent set deflection. Record these values on Data Sheet B2.

5.2 Interpretation of Results. Depending on the equipment used and the practices of re-zeroing the displacement measuring devices between changes of load direction, on Data Sheet B2 the column "**Net Door Rise/Sag**" is the final position of the door relative to its pretest position. It may be automatically read out from the test controller device or it may require addition/subtraction of the "**Set-Deflection**" readings from each load/load direction.

5.3 Test Documentation. Fill out information on Data Sheet B2 to document items such as platform, model year, vehicle/body number, change level, etc. See Data Sheet B3 for an example. Use the attached data sheets provided. Alternative data sheet(s) may be used, but must, at a minimum record equivalent data as the sheets provided in the appendix. The final test report shall be presented in a format consistent with the CG190 Template.

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.

7 Notes

7.1 Glossary.

Deflection: The rise/sag of the door as the specified vertical load is being applied to the door at the latch.

Door In White (DIW): The major panels of the door, welded together, prior to paint and trim.

Set Deflection: The permanent deformation or plastic deformation after the specified vertical load has been applied and removed.

7.2 Acronyms, Abbreviations, and Symbols.

DIW	Door In White
ELPO	Electrophoretic Priming Operation
GSSLT	Global Subsystem Leadership Team

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