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| GM | WORLDWIDE ENGINEERING STANDARDS | Test Procedure | GMW15941 |

# Door Sliding Side System (On Body) - Vertical Rigidity Structural 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 determine the deflection and plastic deformation characteristics of a sliding side door system when subjected to vertical loads applied at the latches. The door system must be mounted in design position on the car body (**on body**).

**1.2 Applicability.** This procedure applies to all passenger cars and light duty trucks having sliding side door systems.

**1.3 Remarks.** The sliding side door is placed in the full open position and a 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 under the latch opening (or at another specified location).

**Note**: GMW15939 performs the same evaluation for the door when mounted on a rigid fixture.

## 2 References

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

**2.1 External Standards/Specifications.**

None

**2.2 GM Standards/Specifications.**

GMW14915 GMW15084 GMW15939

**2.3 Additional References.**

- CG190 Template
- Sliding Side Door Subsystem Technical Specification (SSTS)
- Vehicle Technical Specification (VTS)

## 3 Resources

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

**Note:** Use an area where the test body and test fixturing can be secured to the floor to prevent motion (i.e., an area having tie down slots or a 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.

**3.2 Equipment.**

**Note:** 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.

**3.2.1 Fixturing.**



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**3.2.1.1** Rigid stanchion, with associated tie-down clamps, to provide mounting for the servo linear actuator (Appendix A, 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 enable the door to be loaded in the vertical direction (Appendix A, Figure A1). The load bar typically used has a 2:1 leverage ratio.

**3.2.1.4** Striker adapter device that attaches to the load bar assembly (Appendix, Figure A2).

**3.2.1.5** Appropriate fixturing to secure the body or body truck to the tie-down slot.

**3.2.1.5.1** If a body truck is used, turnbuckles are typically used.

**3.2.1.5.2** If a full vehicle with suspension is used, it is typical to isolate the suspension using bottle jacks and to clamp down the vehicle in the sill plate area (Appendix A, Figure A3).

**3.2.1.6** Miscellaneous stanchions, tie-down hardware, etc., to mount and secure test equipment to the tie down slot.

**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 1.5x the maximum specified load.

**3.2.2.3** Servo linear actuator.

**3.2.2.4** Displacement transducer (Appendix A, Figure A4).

**3.2.2.5** Torque wrenches with a capacity of approximately 1.5x the fasteners required torque specifications.

**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.**

**3.3.1** Body and a Door in White (DIW) that have been through the production paint and bake process and include the following:

- Roller bracket assemblies
- Latches
- Strikers
- Fixed glass

**Note:** The swing-out glass provides no additional structural strength to the door. Therefore, it is not required for this test.

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

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

**3.4 Test Time.**

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| Calendar time: | 1 d |
| Test time: | 4 h |
| Coordination time: | 8 h |

**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 Vehicle Technical Specification/Subsystem Technical Specification (VTS/SSTS) paragraph numbers, if applicable (2.3)

**3.5.1** The following specifications or information are required to run this test.

**3.5.1.1** Load magnitudes, orientation of load directions (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.



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**3.5.1.6** All applicable fastener torques.

**3.5.1.7** Detent and handle efforts (GMW15084 and GMW14915).

**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 torques
- Lubrication
- Environmental extremes
- Location of customer representative load application
- Symmetry (left hand vs. right hand)
- Color
- Mold or die source, etc.

**3.6 Personnel/Skills.** Prior experience in setting up and running similar tests as well as 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 requesting and test engineers should inspect the test items to ensure all material listed in 3.3 is of correct design level and assembled properly. Check the door assembly for bent track sections, bent roller brackets, and damage to the rollers.

**4.1.1.2** If instructed to do so, use the ultrasonic thickness tester or other suitable measuring tool (e.g., a caliper for non-metallic doors) to measure critical part thickness in the areas specified by the requesting engineer. Typical measurements include three randomly selected locations on each of the following parts:

- Door outer panel
- Door inner panel
- Upper frame reinforcements
- Roller bracket reinforcements, if applicable
- Roller brackets

**Note:** The locations listed in 4.1.1.2 are of particular interest because certain locations are significant contributors to the door structural performance. Be aware that measurements near the drawn or 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 are out of specification or made from the wrong stock, contact the requesting engineer for final approval before running the test.

**Note:** If using calipers or micrometers, to avoid erroneous thickness measurements, carefully remove paint, other primers, etc., where the thickness measurements will be taken. Be sure to use non-destructive or non-abrasive means, such as liquid paint remover, so the thickness of the part being measured is not altered.

**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 on Appendix B Data Sheet B1 or an equivalent document. The supplier shall work with the GM requesting engineer to comprehend these requirements.

**4.2 Conditions.**



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**4.2.1 Environmental Conditions.** Unless otherwise specified in this document's text or by the requesting engineer, the typical environmental conditions for this test are the temperature, humidity, and pressure at the test facility (see 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 (which 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.**

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** Perform any functional/operational tests and evaluations as requested or as may be referenced in 3.5.

**4.3.1.2** Any irregular sounds or erratic operation indicating a potential problem with design, manufacture, or assembly should be noted and addressed.

**4.3.1.3** Verify observations with the requesting engineer.

**4.3.1.4** Scribe or otherwise mark the position of the roller bracket assemblies relative to the door and the body. If applicable, also scribe along the doors hem line. This scribing is done to help detect any movement of the hem or roller bracket assemblies that may occur during testing.

**4.3.1.5** Move the door to the full open position.

**4.3.1.6** 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.

**4.3.1.7** 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.

**4.3.1.8** Adjust the vertical rigidity load bar so it is parallel to the door's front latch face (Appendix A, Figure A1).

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

**4.3.1.10** Position and secure the displacement transducer or equivalent measuring device to measure the vertical door movement at the latch (3.5.1.3). Describe in accurate terms or body coordinates the position where the vertical deflection is measured.

**4.3.1.11** Position the servo linear actuator so that its shaft is vertical and in the mid travel position.

**4.3.1.11.1** Make any further alignments necessary and connect the load bar to the load cell, using fasteners that allow sufficient free play so no pre-load will be applied as the fixtures are clamped down.

**4.3.1.11.2** Clamp the load cell fixture and the load bar stanchion to the structure plate.

**4.3.1.12** 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 graph grid similar to the one shown in Appendix C, Figure C1 or an equivalent graph.

**4.3.2.2** Apply the loads specified by the requesting engineer (servo motor ram travel rate is to be approximately 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 the sample plots in Appendix C, Figure C2 and Figure C3 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 800 N down.

**4.3.2.3** Disconnect the actuator from the load bar.

**4.3.2.4** Perform all post test procedures. This will be done after each latch is tested.



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