



Sliding Rear Window Test Procedure

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 develop a standard test procedure to validate the sliding windows.

1.2 Applicability. This standard applies to passenger cars, and to multipurpose passenger vehicles, trucks, and buses of 4536 kg gross vehicle mass (weight) rating or less.

1.3 Remarks. This document is the GM Worldwide Sliding Window Testing Standard. Its purpose is to establish a common test methodology for testing a sliding window to ensure that a high quality world class system is consistently developed and produced. This is a living document and any suggestions or revisions will be reviewed and/or updated annually by the Fixed Glass Global Subsystem Leadership Team (GSSLT).

2 References

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

2.1 External Standards/Specifications.

ISO 12103-1

2.2 GM Standards/Specifications.

GMW3059

GMW3600

GMW14155

GMW14872

2.3 Additional References.

- CG180 5-Phase Template Document (ID).
- GM Security Guidelines. <https://gmweb.gm.com/HR/Security/Pages/FutureGuide.aspx> (ID).
- Program Specific Component Technical Specification (CTS).
- Program Specific Subsystem Technical Specifications (SSTS).

(ID) = This document is limited to internal use within General Motors and shall not be accessed outside this company. Contact the GM Lead Engineer for further instructions.

3 Resources

3.1 Facilities.

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 Thermal Chamber.

- Temperature range -40 °C to +95 °C and continuously adjustable.
- Controlled humidity.
- Recirculating air temperature cabinet.

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- Test room, suitable for the execution of the test.
- Permissible temperature accuracy: $\pm 3^{\circ}\text{C}$.
- Explosion proof.

3.2.2 Test buck (Figure 1) or holding fixture (Figure 2).

3.2.3 Electronic controller.

3.2.4 Vibration table.

3.2.5 Instron machine.

3.2.6 Force gauge.

3.2.7 Digital camera/video camera.



Figure 1: Test Buck



Figure 2: Examples of Test Fixture/Holding Fixture

3.3 Test Vehicle/Test Piece. See Instructions for Sample Number and description.

3.4 Test Time. Note: Test time will vary depending on the specific program designs and equipment capabilities. See the individual procedures in 4.3.

3.5 Test Required Information.

3.5.1 Notification GM Validation is to be notified of test failures within 24 h period of occurrence.

3.5.2 Five (5) Phase. Supplier to develop five phase document for all test failures.

3.5.3 Product Security. Security protocol for the test vehicle must be followed per GM Security Guidelines.

3.6 Personnel/Skills. Prior experience in setting up and running similar tests. Experience in the use of the referenced test equipment.

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4 Procedures

4.1 Preparation.

4.1.1 ALL test setups are to be photographed and approved by GM validation engineer. Pictures of the test setup to be included in the test report or for Subsystem Validation Engineer (SVE) review.

4.1.2 Ensure all materials used in testing conform to GMW3059.

4.1.3 See individual procedures for preparation requirements.

4.1.4 Ensure the proper Personal Protection Equipment (PPE) is available and used during ALL the tests.

4.1.5 Read the associated SSTs, CTS and this GMW in its entirety to ensure a complete understanding of the procedure and requirements of the testing.

4.1.6 Ensure that ALL components are at the proper release level and signed off by the DE and VE prior to testing.

4.1.7 Ensure that all torques have been confirmed before test.

4.1.8 Ensure that all critical bolts have been marked before test.

4.1.9 Confirm Product Security Protocol for the vehicle tested by contacting the Vehicle Performance Manager (VPM). (Vehicles requiring camouflage, etc., must be carefully secured throughout the testing procedure so that no lapse in vehicle security occurs.)

4.2 Conditions.

4.2.1 Environmental Conditions. See individual procedures for requirements.

4.2.1.1 $T_{\max}$ or 85 °C as default.

4.2.1.2 Ambient or 23 °C as default.

4.2.1.3 $T_{\min}$ or -30 °C as default.

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 Opening and Closing Effort Testing.

4.3.1.1 Purpose. To ensure that the operating efforts meet customer expectations for opening and closing the sliding window. (For manual systems only.)

4.3.1.2 Equipment.

4.3.1.2.1 Thermal chamber.

4.3.1.2.2 Force gauge.

4.3.1.2.3 Digital camera.

4.3.1.3 Sample Size. Six (6) samples unless otherwise specified.

4.3.1.4 Preparation. Refer to 4.1.

4.3.1.4.1 Read the proper requirement from the SSTs.

4.3.1.4.2 Thoroughly read this GMW and any other associated GMWs.

4.3.1.4.3 Ensure that proper Personal Protection Equipment (PPE) is used during set up and testing.

4.3.1.4.4 Ensure that the materials are in compliance to GMW3059 and any regulatory requirements for country of sales.

4.3.1.4.5 Confirm Product Security Protocol for the vehicle tested by contacting the Vehicle Performance Manager (VPM). (Vehicles requiring camouflage, etc., must be carefully secured throughout the testing procedure so that no lapse in vehicle security occurs.)

4.3.1.4.6 Ensure that all equipment is available.

4.3.1.4.7 Take picture of the test setup.

4.3.1.5 Conditions. Refer to 4.2.

4.3.1.6 Procedure.

4.3.1.6.1 Set up test equipment.

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4.3.1.6.2 Set up force gauge or Instron.

4.3.1.6.3 Using the force gauge or Instron open the window as simulated from the front passenger seat.

4.3.1.6.4 Record the data.

4.3.1.6.5 Repeat six (6) or more times.

4.3.1.6.6 Average the results and include each data point and the average obtained.

4.3.1.7 Acceptance Criteria. Efforts must be lower than $85 \text{ N} \pm 5 \text{ N}$. See program specific requirements.

4.3.2 Opening and Closing Speeds.

4.3.2.1 Purpose. To evaluate the opening and closing speed meet the program specific requirements.

4.3.2.2 Equipment.

4.3.2.2.1 Thermal chamber.

4.3.2.2.2 Holding fixture.

4.3.2.2.3 Stop watch.

4.3.2.2.4 Digital camera.

4.3.2.3 Sample Size. Three (3) samples minimum.

4.3.2.4 Preparation. Refer to 4.1.

4.3.2.5 Conditions. Refer to 4.2.

4.3.2.6 Procedure.

4.3.2.6.1 Ensure the proper PPE is being used.

4.3.2.6.2 With the window in the closed position, activate the system.

4.3.2.6.3 Record the time to fully open the window.

4.3.2.6.4 Activate the system to close the window.

4.3.2.6.5 Record the time to fully close the window.

4.3.2.6.6 Repeat six (6) times and document the average on the test report.

4.3.2.6.7 Repeat for three (3) samples.

4.3.2.6.8 Using the same samples, place in the thermal chamber.

4.3.2.6.9 Set the thermal chamber to $T_{\min}$ or -30°C if $T_{\min}$ is not specified in the program specific SSTs.

4.3.2.6.10 Soak for 4 h or until the systems meet the desired temperature.

4.3.2.6.11 Repeat 4.3.2.6.1 through 4.3.2.6.7.

4.3.2.6.12 Set the thermal chamber to $T_{\max}$ 85°C if $T_{\max}$ is not specified in the program specific SSTs.

4.3.2.6.13 Soak for 4 h or until the systems meet the desired temperature.

4.3.2.6.14 Repeat 4.3.2.6.1 through 4.3.2.6.7.

4.3.2.7 Acceptance Criteria.

4.3.2.7.1 Must meet requirements in the program specific SSTs.

4.3.2.7.2 Time to fully open or fully close sliding window is $5 \text{ s} \pm 1 \text{ s}$ at 12 V and temperatures from 5°C to 85°C .

4.3.2.7.3 Time to fully open or fully close the sliding window is $5 \text{ s} +2 \text{ s}/-1 \text{ s}$ at 12 V and temperatures from 5°C to -30°C .

4.3.3 Closing and Opening Torque.

4.3.3.1 Purpose. To ensure the opening and closing torque meet the program specific requirements.

4.3.3.2 Equipment.

4.3.3.2.1 Dynamometer or similar.

4.3.3.2.2 Thermal chamber.

4.3.3.2.3 Digital camera.

4.3.3.3 Sample Size. Three (3) minimum.

4.3.3.4 Preparation. Refer to 4.1.

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4.3.3.5 Conditions. Refer to 4.2.

4.3.3.6 Procedure.

4.3.3.6.1 Set up the sliding window motor on the bench or fixture.

4.3.3.6.2 Collect the Opening and Closing Torque before testing

4.3.3.6.3 Attach the dynamometer to record the torque to stall the motor.

4.3.3.6.4 Collect the Opening and Closing Torque

4.3.3.6.5 Repeat at -30 °C.

4.3.3.6.6 Repeat at 85 °C.

4.3.3.7 Acceptance Criteria.

4.3.3.7.1 Opening and Closing Torque shall be < 3 Nm at 23 °C unless otherwise specified in the program specific SSTs.

4.3.3.7.2 Opening and Closing Torque shall be < 5 Nm at -30 °C unless otherwise specified in the program specific SSTs.

4.3.3.7.3 Closing Stall Torque shall be a minimum of 25 Nm and a maximum of 40 Nm unless otherwise specified in the program specific SSTs.

4.3.4 Durability.

4.3.4.1 Purpose. To confirm that the sliding windows will meet the SSTs requirement for durability.

4.3.4.2 Equipment.

4.3.4.2.1 Fixture or test buck.

4.3.4.2.2 Actuation device.

4.3.4.2.3 Electronic counter.

4.3.4.2.4 Digital camera.

4.3.4.3 Sample Size. Six (6) preferred. Must meet Reliability of 95% with a 50% Confidence (R95C50) or program specific requirements.

4.3.4.4 Preparation. Refer to 4.1.

4.3.4.4.1 Ensure the latest engineering change level system is being used.

4.3.4.4.2 Take picture of test setup and equipment.

4.3.4.4.3 Mark the spring location at start of test as a reference for amount of loss of spring travel at end of test.

4.3.4.5 Conditions. Refer to 4.2 and 4.3.4.6.4.

4.3.4.6 Procedure.

4.3.4.6.1 Set up the test buck or fixture.

4.3.4.6.2 Attach the power supply to the actuating arm.

4.3.4.6.3 Conduct test under the conditions in 4.3.4.6.4 and Figure 3.

4.3.4.6.4 Test Parameters.

4.3.4.6.4.1 Durability Cycle Parameters.

- 13.5 V ± 0.5 V measured at the motor terminals.
- Window assembly to be fixtured in vehicle position/mounting angle.
- Test samples to be soaked at each temperature for 4 h before cycling begins.
- Durability profile to be repeated after 1 life for program specific reliability and confidence requirements.
- If there is an option with a defroster, the defroster shall be powered on for 10 minutes and off for 100 minutes throughout the durability test. Must ensure that the on/off cycles are variable – on/off shall not occur when the slider is in the same positions throughout the test.

4.3.4.6.4.2 Environmental Parameters.

- Salt spray solution per ASTM B117.
- Salt spray minimum of 12 mL ± 6 mL of solution evenly over exterior surface with slider closed.

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- Fine dust shall conform to ISO 12103-1.
- Dust apparatus and application method per GMW14872, Appendix C.

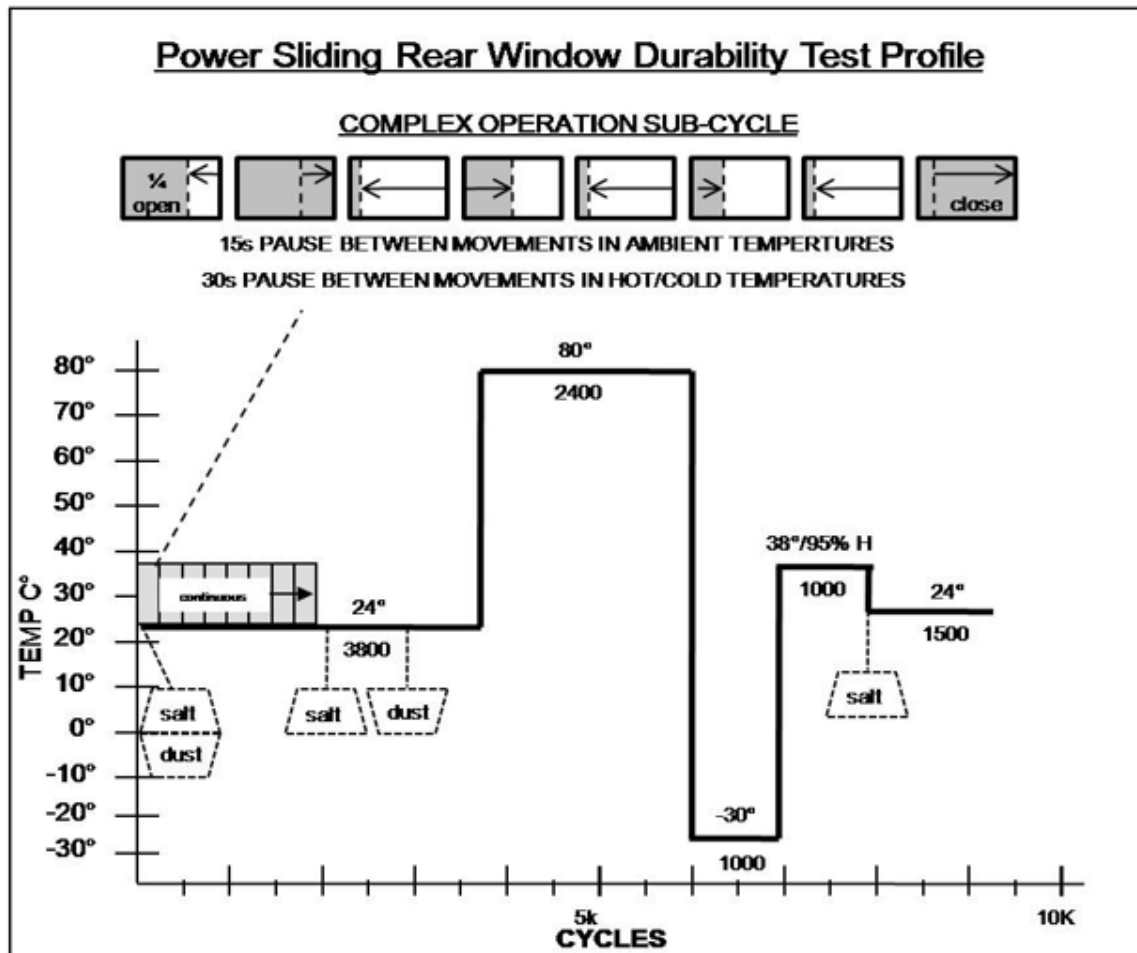


Figure 3: Durability Schedule

4.3.4.7 Acceptance Criteria.

4.3.4.7.1 After 9500 full open/close complex cycles:

- System shall function properly.
- There shall be no water leaks.
- There shall be no objectionable squeaks and rattles.
- There shall be no objectionable motor noises.
- Spring travel shall be a minimum of 80% after 1 life.
- Power contacts must be functional after test, no objectionable wear, no change of resistance > 10%.

4.3.5 Pull Off Testing of the Window Frame.

4.3.5.1 Purpose. To ensure the window carrier does not detach from the window.

4.3.5.2 Equipment.

4.3.5.2.1 Force gauge.

4.3.5.2.2 Holding fixture.

4.3.5.3 Sample Size. Six (6) preferred.

4.3.5.4 Preparation. Refer to 4.1.

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4.3.5.5 Conditions. Refer to 4.2.

4.3.5.6 Procedure.

4.3.5.6.1 Place the window assembly in the holding fixture.

4.3.5.6.2 Place fixture with window into the thermal chamber.

4.3.5.6.3 Set the thermal chamber to -30 °C.

4.3.5.6.4 Soak for 4 h.

4.3.5.6.5 Remove the fixture with window assembly from the chamber and allow to warm to ambient.

4.3.5.6.6 Using the force gauge apply a load of 400 N to the system perpendicular to the window surface at the bottom edge and measure the peak force.

4.3.5.6.7 Repeat on all three (3) samples.

4.3.5.6.8 Operate the assembly to ensure proper function after the test.

4.3.5.6.9 Document any test failures and the load at failure.

4.3.5.6.10 Place the assemblies back into the thermal chamber.

4.3.5.6.11 Set the thermal chamber to 85 °C.

4.3.5.6.12 Soak for 4 h.

4.3.5.6.13 Remove the fixture with window assembly from the chamber and allow to cool to ambient.

4.3.5.6.14 Using the force gauge, apply a load of 400 N to the system perpendicular to the window surface at the bottom edge and measure the peak load.

4.3.5.6.15 Repeat for all three (3) samples.

4.3.5.6.16 Operate the assembly to ensure proper function after the test.

4.3.5.6.17 Document any failures and the load at failure.

4.3.5.7 Acceptance Criteria. Must meet a minimum of 400 N or program specific requirement per the SSTs.

4.3.6 Window Attachment Strength.

4.3.6.1 Purpose. To ensure the window attachments meet the program specific requirements.

4.3.6.2 Equipment.

4.3.6.2.1 Thermal chamber.

4.3.6.2.2 Force gauge or Instron machine.

4.3.6.2.3 Holding fixture.

4.3.6.3 Sample Size. Six (6) preferred.

4.3.6.4 Preparation. Refer to 4.1.

4.3.6.5 Conditions. Refer to 4.2.

4.3.6.6 Procedure.

4.3.6.6.1 Ensure that all PPE is being used during the test.

4.3.6.6.2 Place the window assembly in a holding fixture.

4.3.6.6.3 Apply a constant force perpendicular to the installation surface to the attachment using the force gauge or Instron.

4.3.6.6.4 Record the peak force the attachment withstands until failure.

4.3.6.6.5 Document the location of the attachment.

4.3.6.6.6 Repeat for each attachment location.

4.3.6.6.7 Place the holding fixture with the window assembly in the thermal chamber.

4.3.6.6.8 Set thermal chamber to T_{min} or -30 °C if no T_{min} is documented in the program specific SSTs.

4.3.6.6.9 Allow test samples to soak for 4 h or until the samples reach the soak temperature.

4.3.6.6.10 Repeat 4.3.7.6.1 through 4.3.7.6.6.

4.3.6.6.11 Set the thermal chamber to T_{max} or 85 °C if no T_{max} is documented in the program specific SSTs.

4.3.6.6.12 Allow test samples to soak for 4 h or until the samples reach the soak temperature.

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