



Window System, Dropping Type Power and Manual Performance/Stall 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 operating performance characteristics of dropping, power and manual, window systems.

1.2 Applicability. This procedure applies to all passenger cars, light duty trucks and medium duty trucks having dropping, power or manual, window systems. The procedure also applies to midgates and endgates with dropping windows.

1.3 Remarks.

1.3.1 Power window system operating performance tests can be used to obtain the following data:

1.3.1.1 Travel time.

1.3.1.2 Average run current.

1.3.1.3 Peak run current (excluding motor start up).

1.3.1.4 Average stall current.

1.3.1.5 Average stall voltage.

1.3.1.6 Peak stall current.

1.3.1.7 Average run voltage.

1.3.1.8 Peak run voltage.

1.3.1.9 Peak stall force.

1.3.1.10 Plots of current and voltage vs. time.

1.3.2 Manual window system operating performance tests obtain data for the spindle torques required for window travel.

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.

- Front and Rear Side Closures Global Subsystem Technical Specifications (GSSTS).
- Vehicle Technical Specifications (VTS)

3 Resources

3.1 Facilities. Major Facility: GMNA Body Test Lab or a similarly equipped test facility.

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 list(s) include fixturing and instrumentation typically used by the GMNA Body Test Lab 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.

- Torque Transducer
- Power Window Test Controller
- Includes 0 V to 20 V/50 A DC power supply, computer, printer, wiring harness to connect motor terminal to console, EDS window performance software
- Stall Force Gauge (with sufficient wire to reach console)
- Tape Measure

3.2.1 Fixturing.

3.2.1.1 A body is preferred (with all seals that interface with the doors) to provide upper door frame support and for door overcrown.

Note: Headerless doors (doors with no upper frame) require a body for test purposes. If the test door is not on a body, it may be clamped to a fixture, such as a lab door cart, that will constrain it in approximate design position and prevent it from tipping.

3.2.1.2 Spindle adapter (if using the handheld torque transducer) (for manual window systems only).

3.2.1.3 Power window regulator motor assembly converted to a manual spindle drive assembly (if required). See 3.3.3 and Figure A1.

3.2.2 Instrumentation.

3.2.2.1 Power Window Systems.

3.2.2.1.1 Power window test controller, which includes 0 V to 20 V/50 A DC power supply, personal computer, XY time base plotter (or equivalent data acquisition recorder).

3.2.2.1.2 A stall force gauge and sufficient wiring to connect it to the power window performance console.

3.2.2.1.3 Marking pen.

3.2.2.1.4 Linear measuring device (tape measure).

3.2.2.2 Manual Window Systems. Manual window operating performance console or handheld torque transducer, torque display/calibration box, power supply, XY time base plotter (or equivalent data acquisition recorder) and proper wire connections.

3.3 Test Vehicle/Test Piece.

3.3.1 One (1) door assembly including a manual or power window system and a complete glass guidance system, including belt strips, run channels and any items affecting window system performance.

3.3.2 Vehicle body and associated door mounting hardware, weatherstrips, etc. (refer to 3.2.1.1).

3.3.3 A power window regulator motor assembly converted to a manual spindle drive assembly (if necessary). See Figure A1.

3.3.4 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.

Calendar time:	1 d
Test hours:	1 h
Coordination hours:	3 h

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 test details, running multiple samples (times shown are for 1 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.

3.5 Test Required Information. The requesting engineer is responsible for providing specifications appropriate to the particular vehicle line being tested (reference Vehicle Technical Specifications (VTS)/Subsystem Technical Specifications (STS) paragraph numbers).

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, etc.

Additional supporting information can be found in Appendix B.

3.5.1 Power Window Specifications. The following specifications or information are required to run this test.

3.5.1.1 Stall time. The amount of time that power is supplied to the window system after the glass reaches a full up/full down position.

3.5.1.2 Power supply voltage settings (stall voltage or supply voltage).

3.5.1.3 Resistance of the wires between the power supply and the window motor (if a known supply voltage is used).

3.5.1.4 Location(s) on the window glass to measure stall force.

3.5.1.5 If new seals are installed, the length of time the seals are to be in compression prior to running the performance test (4.3.1.2).

3.5.2 Manual Window Specifications. No specifications are required. Currently, at the GMNA Body Test Lab, the test equipment limits maximum stall torque to 5.6 N·m.

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 Test Time".

4 Procedure

4.1 Preparation.

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

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). If installing a spindle modified power regulator assembly in a door, a hole may need to be drilled to allow spindle egress through the door inner panel.

4.1.2.1 Measure and adjust gap, flushness and seal margin dimensions, if necessary (refer to GMW15938) to ensure the test material meets design specifications (required only if testing a door mounted on a body).

4.1.3 Facilities and/or Equipment Preparation. Record any instrumentation calibration information on Data Sheet A1.

4.2 Conditions.

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 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 (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.

4.3.1 Setup Instructions.

4.3.1.1 If not mounted on a body, secure the door in approximate design position to a door cart.

4.3.1.2 It may be required to wait a specified length of time with the window glass in the full up position with new seals before performing window performance tests. Reference 3.5.1.5.

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4.3.1.3 Motor temperature affects performance test results. If the power windows have been running durability tests, allow the motors to cool approximately 20 minutes before running performance tests.

4.3.1.4 Perform any functional/operational tests/evaluations as requested by responsible engineer. If the window system has not been previously cycled, cycle the window "full up" and "full down" a minimum of 5 times prior to the start of test to assure proper operation and seating of all system components. As applicable, note any irregular sounds or erratic operation indicating a potential problem with design, manufacture, or assembly and verify observations with the requesting engineer.

4.3.2 Test Operation Instructions.

Note: Based on the window system to be tested, go to 4.3.2.1 (power) or 4.3.2.2 (manual).

4.3.2.1 Power Window System.

4.3.2.1.1 Set the window test controller voltage to proper value defined in SSTS for a window performance travel time measurement plot (typically 12.0 V). Move window down then full up to allow voltage to reset. With window in full up position. Roll window down then up, then click on zero near top of Dewesoft screen to zero out the amperage channel.

4.3.2.1.2 Record window voltage and current data with the window moving from full up position to full down position with an adequate stall and then returning back to the full up position with an adequate stall.

4.3.2.1.3 Set window test controller voltage to proper value defined in SSTS for stall force measurement plot (typically 10.5 V). Move window down then full up to allow voltage to reset. Move window from full up position down approximately 125 mm.

4.3.2.1.4 Using 3.5.1.4 for a location, install the stall force gauge on the window at the glass center of gravity and mark its location (gauge location should be consistent during multiple testing). Position the stall force gauge so no rotation of the glass or gauge occurs during the next step. Do this by adjusting the tilt feet on the gauge to make the gauge align with the glass. See Figure A2.

4.3.2.1.5 For windows with Power Window Electronics (PWE), disable the obstacle detection function using the window test controller.

4.3.2.1.6 Record window voltage, current and stall force data with the window moving from the 125 mm down position to an adequate full up stall position and then returning back to the 125 mm down position.

4.3.2.1.7 Repeat steps 4.3.2.1.1 thru 4.3.2.1.4 for all desired windows.

4.3.2.1.8 After all window performance plots are collected (see Figure A3 for stall force plot and Figure A4 for performance plot), enable the obstacle detection function. Reset the window voltage back to the desired value (typically 13.5 V for window durability cycling) on all windows. Run each window full up, full down then full up again. This will normalize PWE windows.

4.3.2.2 Manual Window System.

Note: Two (2) methods are shown below (4.3.2.2.1 and 4.3.2.2.2). Go to the appropriate paragraph for the method to use.

4.3.2.2.1 Manual Window Operating Performance Console Method.

4.3.2.2.1.1 Remove the window handle from the regulator spindle. Align the window regulator's spindle centerline to the drive motor centerline. An adapter is available to assist in alignment. Remove the adapter and replace the window handle. Attach the manual regulator handle fork adapter to the motor spindle shaft. Allow approximately 2 mm clearance between the face of the fork adapter and the handle. See Figure A5.

4.3.2.2.1.2 Connect the 2 power cords from the drive motor to the back of the manual window console. Plug the console into a 220 V AC outlet. Turn on the power to the console. Using the manual override switches, run the window 1 complete cycle to make sure the connection is correct and the system will cycle. Cycle the window to the full up position.

4.3.2.2.1.3 Using available laboratory data acquisition equipment (i.e., XY time based plotter, or equivalent data acquisition recorder) record the data as the window is run to the down position, and plot the torque vs. time curve. Repeat this graph creation as the window is run back to the up position. The up and down torque vs. time curves are typically overlaid on the same graph. Label the two curves for the up and down travel appropriately. Also record the test date, number of window cycles, test temperature, work order number, platform, door identification and any other appropriate information on the graph. See Figure A6.

4.3.2.2.2 Handheld Torque Transducer Method (Manual Window Systems and Spindle Modified Power Window Systems).

4.3.2.2.2.1 Plug in the handheld torque gun power supply and the plotter to a 120 VAC outlet.

4.3.2.2.2.2 Adjust the power supply voltage so that it is no greater than 17.5 V. Due to torque gun restrictions, typically, 16 V is typically used.

4.3.2.2.2.3 Connect the red and black plugs on the torque gun power cord to the red and black receptacles on the power supply (red to red, black to black). The green receptacle is not used on the power supply.

4.3.2.2.2.4 Connect the gray wire from the torque gun to the blue torque display/calibration box.

4.3.2.2.2.5 If present, remove the window handle. Place the torque gun with the appropriate spindle adapter on the regulator spindle (See Figure A7). Operate the gun to determine which button corresponds to up and to down, and move the glass to the full up position.

4.3.2.2.2.6 Connect the calibration box to available laboratory data acquisition equipment (i.e., XY time based plotter, or equivalent data acquisition recorder). Use the handheld torque transducer to run the window to the down position, and plot the torque vs. time curve. Repeat this graph creation as the window glass is run back to the up position. The up and down torque vs. time curves are typically overlaid on the same graph. Label the two curves for the up and down travel appropriately. Also record the test date, number of window cycles, test temperature, work order number, platform, door identification and any other appropriate information on the graph. See Figure A8.

4.3.3 Post Test Instructions. No post-test evaluations are required.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Not applicable.

5.3 Test Documentation. Appendix A Data Sheet A2 is to be used to record and report the data from the testing.

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

7 Notes

7.1 Glossary.

Design Position: Orientation of a body part in the position it assumes when attached to a built vehicle on level ground.

Door Overcrown: A designed interference condition that exists between the door upper frame or header and body, when the door is in the closed position, to prevent water leaks and wind/road noise.

Note: A similar condition exists for the window of a headerless door when it reaches the "full up" position.

Dropping Window: A window system that opens and closes by sliding vertically up and down.

Stall Force (Power Window Systems): For this procedure, it is defined as the force exerted by the window system against the upper horizontal glass run seal when the glass is traveling upward.

Stall Torque (Manual Window Systems): The maximum available torque provided by the test equipment (currently 5.6 N·m).

Torque Gun or Gun: Slang terms used in the text to represent the Handheld Torque Transducer mentioned in 3.2.1.2 and 3.2.2.2.

7.2 Acronyms, Abbreviations, and Symbols.

GSSLT	Global Subsystem Leadership Team
GSSTS	Global Subsystem Technical Specifications
No.	Number
PWE	Power Window Electronics

VTS Vehicle Technical Specifications

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Test to GMW15081

9 Release and Revisions

This standard was originated in February 2006. It was first approved by the Global Glass Guidance SSLT in July 2006. It was first published in August 2006.

Issue	Publication Date	Description (Organization)
1	AUG 2006	Initial publication.
2	JUN 2011	Updated GMN procedure references to GMW procedures thru out. Changed section 4.3.2.2.1.3 and 4.3.2.2.2.6 to allow any data acquisition equipment to be used, instead of only XY time based plotter option. Updated Figure A2 to change TWO to Activity request. (Glass Guidance GSSLT)
3	FEB 2017	2.3 removed "EDS performance software package" wording. Changed "performance console" to "test controller" in 3.2 and 3.2.2.1.1. 4.3.2.1 updated entire section on power window controller test instructions. Eliminated the term "megadac" from sections 4.3.2.2.1.3 and 4.3.2.2.2.6. Deleted previous Figure 2, performance window test screen. Changed all figure numbers and references to compensate for deleted figure. Updated Figures 3 and 4, plots for stall force and performance. Deleted section B1.6 pertaining to SI units; no longer applicable. (Body – Side Closures GSSLT)