



Reversing Behavior Test Procedure for Electric Window Regulators Equipped with Obstacle Detection

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 evaluate the dynamic performance of electrically operated window regulators with obstacle detection.

1.2 Applicability. All side window systems equipped with electrically operated window regulators with obstacle detection.

1.3 Remarks. In order to satisfy customer and system requirements, the reversing behavior of electrically operated window regulators with obstacle detection shall be optimized. During the development period, the following procedures have to be performed at the same time and with the same vehicle:

- GMW14261
- GMW15364

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14264 GMW15364

2.3 Additional References.

- Component Technical Specification (CTS)
- Subsystem Technical Specification (SSTS)
- Vehicle Technical Specification (VTS)

3 Resources

3.1 Facilities. GM designated test center or proving ground (Milford, Dudenhofen, or Holden).

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. Not applicable.

3.3 Test Vehicle/Test Piece. Vehicle with electrical window regulators equipped with obstacle detection.

3.4 Test Time.

Calendar time: 3 d

Preparation Time: 3.5 h/door

Test hours:	2.5 h (2 doors) 4.0 h (4 doors)
Coordination hours:	2 d for prototype 1 d for production

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Two (2) workshop mechanics with knowledge of measuring technology.

4 Procedure

4.1 Preparation. The door system shall be evaluated to ensure conformance to the design. Reference static reversal force measurements shall be recorded by the system manufacturer prior to test, ensuring adherence to design requirements.

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 Summer and Winter Tests. Temperature must be in the specified performance range, - 30 °C to +80 °C. Generally the test should be performed between -25.0 °C to +35 °C. False reversals are allowed to occur below -30 °C to -40 °C due to increased seal friction but the maximum force generated is not allowed to exceed the legal requirements.

4.2.1.2 Basic Measurements. Dry weather within a temperature range of $T_A = +5\text{ °C}$ to $+25\text{ °C}$ and an air humidity of 20% to 60%.

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 General. The basic tests shall be performed at the designated GM Proving Ground (or equivalent) in order to enable both a direct comparison of different Power Window Electronic (PWE) versions and a comparison of different vehicle model series. In the Appendix A, road schedules are provided for the Dudenhofen (GME), Milford (GMNA) and Holden Proving Grounds. Other proving grounds can use these schedules as a guide for their testing.

4.3.1.1 The test shall be performed with a vehicle that includes the stiffest chassis suspension variant and achieves the maximum speed of the designated model series.

4.3.1.2 The procedure and conditions for the reversing behavior test shall be the same for all window regulator versions (scissors-type, cable, etc.) The data sheets shall serve as a basis for the evaluation matrix. For evaluation of the reversing behavior, refer to the relevant Subsystem Technical Specification (SSTS).

4.3.1.3 Evaluations shall be performed in the same manner for all regulator and PWE versions.

4.3.1.4 The vehicle shall be equipped with all parts relevant to the test.

4.3.1.5 Heating, Ventilation, and Air Conditioning (HVAC) Adjustment. All vent nozzles shall be fully opened and directed towards the drop window.

4.3.1.5.1 The fan shall be adjusted to the maximum speed.

4.3.1.5.2 The switch shall be set to fresh air supply (if present in vehicle).

4.3.1.5.3 The selector switch shall be set to ventilation of the side window and windscreen.

4.3.2 Confirming Conformance of the Glass Guidance System to Design Requirements (only for Prototypes). The door and glass guidance system (inclusive of seals) shall be checked and corrected per the door system SSTS.

4.3.3 Testing the Drop Window Reversing Behavior during Driving Operation (except at maximum Test Speed). Reversing behavior shall be tested in all window positions. In order to test the entire travel of the window, 50% (five (5) window actuations each) of the closing operations shall be performed in the upper and 50% (five window actuations each) in the lower window position areas. The number of window closing actuations shall be performed according to Appendix A and the number of undesired instances of reversing shall then be recorded in the data sheet.

4.3.4 Reversing Behavior during Glass Run Channel Entry during Driving Operation. According to GMW15364 and conducted at the maximum vehicle speed as specified in the Vehicle Technical Specification (VTS).

4.3.4.1 Glass Run Channel Entry. The maximum test speed can be found in GMW15364 if not specified otherwise in the relevant SSTS and VTS. The number of undesired reversals at the maximum test speed shall be recorded on Appendix A datasheets. The drop windows shall be actuated individually for this test. In case one window does not reach the closed position at the maximum test speed, the speed at which the drop window still closes securely shall be recorded in the test report.

4.3.5 Testing of Reversing Behavior during Door Closing. The drop window shall not reverse during a door closure if the window system can be closed from outside, e.g., with a remote control. The required door closing velocity can be found in the relevant SSTS.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. The permissible values shall be taken from the relevant CTS or SSTS. The number of undesired system reversals tabulated in Appendix A shall be evaluated via subjective evaluation according to GMW14264 as per the evaluation matrix. Pass/Fail criteria shall be determined by the GM responsible engineer in conjunction with the Global Glass Guidance GSSLT.

5.3 Test Documentation. The results shall be documented on the datasheets in Appendix A for the proving ground that the test was conducted and presented in a test report with reference to this standard.

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.

Obstacle Detection: An electronic safety device which opens the window automatically in the event an obstacle is detected.

Remote Closing: The closing of the drop window from outside, of the vehicle with a remote control device.

Reversal: Automatic opening of the drop window e.g., in the event an object is detected in the window opening. A reversal may occur unintentionally due to false detection of an object by the window regulator PWE caused by irregular glass guidance system friction, rough road inputs, and low or high voltage.

Reversing Behavior: The reversing behavior of a drop window corresponds to an evaluation of the number of undesired reversing operations (reversing errors) of the system while driving and when stationary.

7.2 Acronyms, Abbreviations, and Symbols.

CTS	Component Technical Specification
DPG	Dudenhofen Proving Ground
FL	Front Door, Left
Fr	Front Door, Right
F _v	Displacement Force of Drop Window
GRC	Glass Run Channel
GSSLT	Global Subsystem Leadership Team
HVAC	Heating, Ventilation, and Air Conditioning
MPG	Milford Proving Ground
PWE	Power Window Electronic