



Rear Window and Quarter Window Vehicle Defrost 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 standard is to validate the performance capability of electrically heated rear or quarter windows under a static condition. The data will be used to predict performance of the vehicle level dynamic test.

1.2 Applicability. This standard applies to all passenger cars and trucks that have an electrically heated fixed window (rear or side).

1.3 Remarks. This document is intended to test performance requirements of a heated rear window or quarter window. This document is the GM worldwide fixed glass testing standard for static defrost test. Its purpose is to establish a common test methodology for fixed heated glass 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.

None

2.2 GM Standards/Specifications.

9985864	GMW3600	GMW15760
GMW3059	GMW14264	

2.3 Additional References.

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

(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. The test facilities shall be accredited to the International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) standards or by the International Laboratory Accreditation Cooperation (ILAC).

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 Personal Protection Equipment (PPE).

3.2.2 Environmental chamber capable of temperatures to -40 °C. The environmental chamber must be large enough to hold a fixture with the production glass and have an area for viewing and taking pictures. A thermal chamber large enough to contain fully assembled body glazing, having the following capabilities:

- Controlled humidity.
- Explosion-proof thermal cabinet for circulating air operation with extraction.
- Test Room: Suitable size.
- Executions: Suitable size.

3.2.3 Fixture for holding the glass in near-vertical position.

3.2.4 Stopwatch.

3.2.5 Oil-based marker.

3.2.6 A 9 V to 16 V power supply capable of 20 A, and if necessary, an electrical power supply device that reflects vehicle electrical interface (mating connector, wire gauge, control box, etc.)

3.2.7 Voltage and current measuring equipment for recording.

3.2.8 Spray bottle.

3.2.9 Digital camera capable of taking high quality pictures.

3.2.10 GM approved windshield cleaner 9985864 or equivalent to ensure water sheeting action.

3.2.11 GM approved test route.

3.2.12 Temperature gauge.

3.3 Test Vehicle/Test Piece. Test samples shall be of production-intent design and material for design validation (DV) or production-intent design and materials manufactured with production processes (home line) for product validation (PV). Any changes to the components or material, e.g., design, fit, form, function, properties, manufacturing process, and/or location of manufacture, require revalidation. GM shall approve validation methods for product/process changes before the supplier is committed to the change. Refer to GMW3600.

3.3.1 For the vehicle test, the vehicle with the lowest alternator rating, the smallest battery, and the maximum number of electrical components for the respective vehicle model shall be used.

3.3.2 All components/systems used in testing shall be within drawing specifications and have supporting data prior to start of test.

3.3.3 All test samples are to be selected using GMW15760 Multivariable Sample Selection.

3.3.4 All Test Samples are to be individually marked using a unique numbering system.

3.3.5 All Test Samples are to have a Bill of Materials (BOM). The BOM is to identify all release levels of the components in the test samples.

3.3.6 All Test Samples shall have dimensional data and all quality issues identified prior to conducting any testing or evaluation.

3.4 Test Time. See test times under each individual procedure.

3.5 Test Required Information. Requirements from the Subsystem Technical Specification (SSTS) or respective specification are necessary in order to execute test methods in this procedure. (See Section 4). For equipment and test sample details, see 3.2.

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 documents for all test failures. The Five Phase document shall be submitted within 48 h of test failure.

3.6 Personnel/Skills. The test facility shall have sufficient personnel with the necessary education, training, technical knowledge, and experience for performing the required tests. Prior experience in setting up and running similar tests. Experience in the use of the referenced test equipment.

4 Procedure

4.1 Preparation.

4.1.1 Before carrying out the test, ensure the following:

- Window heater complies with the release status.
- Window and window heater are undamaged.
- Window is clean.
- All electrical components function properly.
- Any possible deviations are to be corrected. If this is not possible, the deviations are to be noted.

4.1.2 The vehicle or the window shall be either on an open piece of ground or in the climatic chamber and cooled to $-20\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$. The window is then sprayed with water from a manual spray bottle to ice it. The water is sprayed onto the window from a distance of 30 cm from left to right and from top to bottom. The spray points are located 20 cm from one another. Each spray point is sprayed twice.

4.1.3 Read the proper requirement from the SSTs.

4.1.4 Thoroughly read this GMW and any other associated GMWs.

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

4.1.6 Ensure the materials comply with GMW3059 and any regulatory requirements for country of sales.

4.1.7 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.)

4.1.8 Ensure that ALL components are at the proper release level and signed off by the Design Engineer (DE) and Vehicle Engineer (VE) prior to testing.

4.1.9 Ensure that all torques have been confirmed before test.

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

4.1.11 Ensure that the fixture is in proper working order – proper representation of the body, no damage from previous test.

4.1.12 Ensure that all equipment is in proper working order, equipment is calibrated, counters are working properly.

4.1.13 Document environmental conditions (temperature, humidity, time and date) before start, during and end of test. All test samples are to be properly labeled using a permanent unique identifier. The numbering system shall be used in all phases of testing including DV, PV, Post Validation Audit (PVA), Development and any test incident retesting.

4.1.14 All test samples shall have a BOM that indicates release levels of the subsystem and components.

4.2 Conditions. All conditions specified shall be targeted toward the specified value with any given ($\pm$) tolerance used to compensate for variation. During testing, conditions specified shall not be readjusted within the tolerance unless it is to maintain the particular test condition within the specified tolerance. If such an adjustment is made, it shall be approved by the appropriate GM engineer prior to the start of any testing. Unless otherwise specified, perform the tests in the as-received condition without any special preconditioning.

4.2.1 Environmental Conditions. The test temperature shall be $-23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$.

4.2.1.1 No precipitation (rain, snow, fog, etc.) on the window.

4.2.1.2 When performing the road test, there shall be no dirt, snow, or similar potential contaminants on the window.

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 Stationary Test.

4.3.1.1 **Purpose.** To ensure that the defrost/defog system is properly functioning while vehicle is stationary.

Note: The test can be performed as a road test or in the climatic chamber.

4.3.1.2 Test Equipment.

4.3.1.2.1 Digital camera.

4.3.1.2.2 PPE.

4.3.1.2.3 Thermal chamber.

4.3.1.2.4 Stop watch.

4.3.1.3 Test Samples. Unless otherwise specified 6 samples are to be used. GMW15760 is to be used to select test samples.

4.3.1.4 Test Time.

Calendar time: 1 d

Test time: 8 h

Coordination time: 2 h

4.3.1.5 Test Preparation. See 4.1.

4.3.1.6 Test Conditions. See 4.2.

4.3.1.7 Test Procedure.

4.3.1.7.1 Place the test sample or vehicle in the thermal chamber.

4.3.1.7.2 Set the chamber to -30 °C.

4.3.1.7.3 Allow the test sample to soak for 4 h or until the test sample reaches the test temperature.

4.3.1.7.4 Spray a layer of ice on the glass surface per steps in Appendix C.

4.3.1.7.5 Once the layer of ice has reached ambient temperature, the window heater is switched on with the engine running (idle speed). At the same time, all electrical components (light, ventilation, radio, seat heater, etc.), with the exception of the wipers, shall be switched on at full power.

Note: The ventilation system shall be directed only to the footwell when the heater is switched off.

4.3.1.7.6 The time shall be measured as follows, using a stopwatch:

4.3.1.7.6.1 Until the first visible defrosting is completed.

Note: If the window heater automatically switches off before the window is completely free of ice, the area that is free of ice up to that point shall be evaluated subjectively according to GMW14264. The window heater shall then be switched on again and the overall time required to defrost the window completely shall be measured.

4.3.1.8 Test Requirements or Acceptance Criteria. Defrost/Defog shall meet program specific requirements from the program CTS/SSTS.

4.3.2 City Test.

4.3.2.1 Purpose. To ensure that the defrost/defog system is properly functioning while vehicle is driving in city traffic.

Note: The test can be performed as a road test or in the climatic chamber.

4.3.2.2 Test Equipment.

4.3.2.2.1 Digital camera.

4.3.2.2.2 PPE.

4.3.2.2.3 Thermal chamber.

4.3.2.2.4 Stop watch.

4.3.2.3 Test Samples. Unless otherwise specified 6 samples are to be used. GMW15760 is to be used to select test samples.

4.3.2.4 Test Time.

Calendar time: 1 d

Test time: 8 h

Coordination time: 2 h

4.3.2.5 Test Preparation. See 4.1.

4.3.2.6 Test Conditions. See 4.2.

4.3.2.7 Test Procedure.

4.3.2.7.1 Place the test sample or vehicle in the thermal chamber.

4.3.2.7.2 Set the chamber to -30 °C.

4.3.2.7.3 Allow the test sample to soak for 4 h or until the test sample reaches the test temperature.

4.3.2.7.4 Spray a layer of ice on the glass surface per steps in Appendix C.

4.3.2.7.5 Once the layer of ice has reached ambient temperature, the window heater is switched on with the engine running. At the same time, all electrical components (light, ventilation, radio, seat heater, etc.,) except the wipers, shall be switched on at full power.

Note: The ventilation system shall be directed only to the windshield when the heater is on full power. The run is started immediately.

Note: The maximum speed is limited to 50 km/h and shall be interrupted with occasional stops (traffic lights, etc.)

4.3.2.7.6 The time shall be measured as follows, using a stopwatch:

- Until the first visible defrosting.
- Until defrosting is completed.

Note: If the window heater automatically switches off before the window is completely free of ice, the area that is free of ice up to that point shall be evaluated subjectively according to GMW14264. The window heater shall then be switched on again and the overall time required to completely defrost the window shall be measured.

4.3.2.8 Test Requirements or Acceptance Criteria. Defrost/Defog shall meet program specific requirements from the program CTS/SSTS.

4.3.3 Overland Test. This test shall be performed with the side and rear windows iced.

4.3.3.1 Purpose. To ensure that the defrost/defog system is properly functioning while vehicle is driving in rural traffic.

4.3.3.2 Test Equipment.

4.3.3.2.1 Digital camera.

4.3.3.2.2 PPE.

4.3.3.2.3 Thermal chamber.

4.3.3.2.4 Stop watch.

4.3.3.3 Test Samples. Unless otherwise specified 6 samples are to be used. GMW15760 is to be used to select test samples.

4.3.3.4 Test Time.

Calendar time: 1 d

Test time: 8 h

Coordination time: 4 h

4.3.3.5 Test Preparation. See 4.1.

4.3.3.6 Test Conditions. See 4.2.

4.3.3.7 Test Procedure.

4.3.3.7.1 Place the test sample or vehicle in the thermal chamber.

4.3.3.7.2 Set the chamber to -30 °C.

4.3.3.7.3 Allow the test sample to soak for 4 h or until the test sample reaches the test temperature.

4.3.3.7.4 Spray a layer of ice on the glass surface per steps in Appendix C.

4.3.3.7.5 Once the layer of ice has reached ambient temperature, the window heater is switched on with the engine running. At the same time, all electrical components (light, ventilation, radio, seat heater, etc.,) except the wipers, shall be switched on at full power.

Note: The ventilation system shall be directed only to the windshield when the heater is on full power. The run is started immediately.

Note: The run shall be performed at a constant 100 km/h.

4.3.3.7.6 The time shall be measured as follows, using a stopwatch:

- Until the first visible defrosting.
- Until defrosting is completed.

Note: If the window heater automatically switches off before the window is completely free of ice, the area that is free of ice up to that point shall be evaluated subjectively according to GMW14264. The window heater shall then be switched on again and the overall time required to completely defrost the window shall be measured.

4.3.3.8 Test Requirements or Acceptance Criteria.

- Defrost/Defog shall meet program specific requirements from the program CTS/SSTS.
- Photos every minute of the defrosting test are to be included in the test report – see Appendix D.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Pictures of results will be reviewed with the GM engineer to determine the percentage cleared at each one-minute interval.

5.3 Test Documentation. Record all test results on Data Sheet A1 (Appendix A), Data Sheet B1 (Appendix B) and Data Sheet C1 and C2 (Appendix C), and include the data sheets in the test report. Include photographs of the test setup and the individual test results. Test videos are to be stored in Global Document Management (GDM) for a minimum of three (3) months after Start of Regular Production (SORP). Name the video files using the format: “2011 D1SB-N AIP Water Management Wiper Motor Results 23July10” and reference the file in GM Evaluation Report. Test results and still pictures of concerns from videos are to be documented on GM Evaluation Report. Examples of still pictures can be found in Appendix D, Figures D1 through D4.

5.4 Samples/Components. Samples of components or material released to this standard shall be tested for conformity with the requirements of this standard and approved by the responsible GM Department prior to the start of delivery of production level components or materials. Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture requires a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release.

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If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases, a shorter test can be agreed to between the responsible GM department and the supplier.

5.4.1 Record measurements and results as specified by individual procedures in the final test report.

5.4.2 Document the test results in a test certificate or report.

The following are required for **all** test reports:

- Test equipment, including:
 - a. Serial numbers.
 - b. Calibration information.
- Description of test material (including design revision, lot or batch, options, etc.)
- Test specification date, pertinent setup information, and photographs

5.4.3 Photos. Photos of the test fixture, test setup and test sample shall be added to the test report. Photos of the defrosting over time are to be attached to the test report. See Appendix D for examples.

5.4.4 Evaluation Reports. The supplier shall write evaluation reports to document the results of all validation activities and shall make the test results and evaluation reports available to GM engineers upon request (see GMW3600). All test reports are to be in English and available 2 weeks after test completion.

5.4.5 Required Documentation. A 5 Phase Document (use CG180 template) for all test failures within 24 h period of occurrence. The following is also required for all test reports:

- Procedure number (with Version Date) and section numbers on all test reports.

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- Requirement being met and SSTS requirement number.
- Part traceability – include cavity number, serial number, tool number, engineering change level (ECL), etc., to specifically identify the part.
- All test parameters for environment and equipment.
- Any authorized deviations to the plan.
- Test setup shall be photographed.
- Road map as required.
- Dimensional data on the test part as required.

5.4.6 The supplier shall use the current, approved 5-Phase Template (CG180) to document program issues during virtual vehicle assessment. The template shall be provided by GM Product Engineering. 5-Phase is to include the following, at a minimum:

1. Issue Description
2. Root Cause Analysis
3. Containment
4. Implementation
5. Evaluation/Validation

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.

In general, a risk assessment needs to be performed for every driving instruction prior to executing this standard. (**Note:** National law needs to be considered while performing a risk assessment.) The required rating of risk by exposure probability and possible violation will be done in a separate document. Every identified risk must be named inside the risk assessment for the relevant driving instruction in order to announce that risk to employees. Within the risk assessment, the vehicle equipment and different vehicle build stages have to be considered. After performing a risk assessment, non-acceptable risk needs to be mitigated by appropriate countermeasures. Here technical measures are preferred because these are independent from attendant circumstances. In case technical measures are not appropriate, organizational and/or personal measures will apply. This includes training, wearing of Personal Protection Equipment, or arrangement of idle time.

6.1 Safety Precautions.

6.1.1 Instrumentation and other test equipment must be securely mounted in accordance with proving grounds traffic safety guidelines for mounting and usage of in-vehicle instrumentation.

6.1.2 All running lights and vehicle safety features must be operational according to proving grounds rules for running lights and power windows. Exterior lights must not be obscured by styling add-ons, covers or camouflage packages. The horn may be disabled because of steer angle transducer installation.

6.1.3 A helmet is required in accordance with the regulations of the test facility. The vehicle should never be operated in a manner where the vehicle leaves the roadway or goes onto the shoulder for any reason.

6.1.4 Check for proper attachment of the steering wheel to the gear via the intermediate shaft. If it feels loose or abnormal, do not run the test until the parts are properly assembled according to the intended design.

6.1.5 Check to be certain that all wheel lugs are present and have the specified torque. Loose or missing wheel fasteners are to be replaced, installed or tightened before the test may begin.

6.1.6 The driver's seatbelt must be worn at all times during the test. Passengers accompanying the test operator must also be safely belted in the vehicle, preferably in the right rear seat.

Note: Passengers are allowed for observation or training purposes.

6.1.7 If a crossbar is used to hold the steering wheel angle transducer base plate, the passenger side airbag is to be disabled or disconnected.