



Heated Windshield Test Procedures

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. This test is to evaluate the performance of a heated windshield under environmental conditions. Some tests are executed in the vehicle. Others can be conducted at a component level.

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 Glazing Testing Standard. Its purpose is to establish a common test methodology for heated windshield glazing systems 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.

GMW3059	GMW3116	GMW14527	GMW15531
GMW3067	GMW3425	GMW14528	GMW15698
GMW3091	GMW3600	GMW14650	
GMW3097	GMW8518	GMW15470 (ID)	

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

2.3 Additional References.

- CG180 5-phase Template (ID)
- Component EMc and ENvironmental Test Database (CEMENT)
- GM Product Security Guidelines (<https://gmweb.gm.com/HR/Security/Pages/FutureGuide.aspx>)
- GM Research and Development (R&D) Report AS-598, "Hearing Acuity Standard for Squeak and Rattle Evaluators."
- Program specific Component Technical Specification (CTS)
- Program Specific Subsystem Technical Specification (SSTS)
- Vehicle Technical Specifications (VTS).

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.

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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 large enough to minimally contain one (1) test buck. The chamber should also meet the following:

- Temperature Range (-40 °C to +95 °C) and continuously adjustable.
- Controlled humidity.
- Recirculating air temperature cabinet.
- Test room, suitable for the execution of the test.
- Permissible temperature accuracy: ± 3 °C.
- Explosion proof.

3.2.2 Digital camera/video camera.

3.2.3 Force gauge with hook attachment.

3.2.4 Measuring scale/ruler.

3.2.5 Power supply, 9 V to 16 V, capable of 20 A and capable of producing the minimum and maximum voltage and current required in the program specific SSTS/CTS.

3.2.6 Grey-Field Polariscope or similar.

3.2.7 Temperature measuring equipment.

3.2.8 Snow Making Machine. Specially engineered snow launcher gun for purposes of snow making on a vehicle windshield in outdoor ambient. Manufacturer – Ratnik Industries, Inc., Rochester NY. or similar approved by General Motors Subsystem Validation Engineer (SVE) and Design Engineer (DE).

3.2.9 Personal Protection Equipment (PPE).

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.

Unless otherwise specified, three samples of components or systems shall be tested.

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

3.4 Test Time.

Calendar time: 10 d

Test time: 100 h

Coordination time: 20 h

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 documents 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.

3.6.1 Sound Evaluators.

3.6.1.1 Hearing Requirements. It is recommended that all evaluators for customer actuated sound have a hearing test. Any professional hearing test is acceptable, but the following test is given is a reference: GM R&D Report AS-598, "Hearing Acuity Standard for Squeak and Rattle Evaluators."

3.6.1.2 Auditor Skill Level. Evaluators shall have completed 2 to 3 prior CAS vehicle evaluations under the supervision of an experienced CAS Evaluator.

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4 Procedure

4.1 Preparation. Read the proper requirement from the SSTS and this GMW thoroughly. Ensure that proper PPE is used during set up and testing.

4.2 Conditions.

4.2.1 Environmental Conditions. Temperature tolerance: $\pm 3^{\circ}\text{C}$.

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 Material Performance.

4.3.1.1 Purpose. To ensure that the materials used in the heated windshield meet the program specific requirements.

4.3.1.2 Test Equipment. See specific procedures for applicable equipment.

4.3.1.3 Test Samples. Three systems.

4.3.1.4 Test Time. See the specified GMWs for test time.

4.3.1.5 Test Preparation. See 4.1.

4.3.1.6 Test Condition. See 4.2.

4.3.1.7 Test Procedures.

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

4.3.1.7.2 Ensure that the materials are in compliance to GMW3116 and any regulatory requirements for country of sales.

4.3.1.7.3 Ensure that the materials are in compliance to GMW14650.

4.3.1.7.3.1 Weatherometer Resistance. Components on the exterior that are always exposed (i.e., seals, encapsulations, external wind deflectors) class 3 of the exposure limit requirement.

4.3.1.7.3.2 Resistance of Material to Heat Ageing Requirement. Test parts shall show no significant surface changes, particularly changes in color or gloss, no embrittlement, no increase in hardness, no objectionable shrinkage or other changes detrimental to serviceability. Test pieces shall comply with the dimensions specified on the drawing after completion of the test (parts must be checked on the checking fixture before and after exposure).

4.3.1.7.3.3 Component Dimensional Stability (Test at $T_{\min} = -40^{\circ}\text{C}$) Requirement. Test pieces shall show no cracking, crazing, appreciable color changes, discoloration, cloudiness, blistering, objectionable shrinkage, deformation, loss of adhesion to the substrate between layers of the composite or other changes detrimental to serviceability. Test pieces shall comply with the dimensions specified on the drawing after completion of the test (parts must be checked on the checking fixture before and after exposure). Measurements shall be made after each stage of the two (2) cycles. The measurements shall be taken within 1 minute of removing the part from the environment. The measurement points shall be determined by the GM Design Release Engineer or the GM Validation Engineer.

4.3.1.7.3.4 Resistance to Humidity Requirement. Test pieces shall show no significant surface changes, particularly changes in color or gloss or other changes detrimental to serviceability. Test pieces shall comply with the dimensions specified on the drawing after completion of the test (parts must be checked on the checking fixture before and after exposure).

4.3.1.8 Test Requirements. See program Specific SSTS and VTS for requirements if different than those specified in the specified test.

4.3.2 Electrical Tests.

4.3.2.1 Watt Density.

4.3.2.1.1 Purpose. To confirm that the heated windshield meets the electrical requirements specified in the program specific SSTS/CTS.

4.3.2.1.2 Test Equipment.

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4.3.2.1.2.1 Digital camera/video camera.

4.3.2.1.2.2 Power source capable of producing the minimum and maximum voltage and current required in the program specific SSTS/CTS.

4.3.2.1.2.3 Voltmeter/Multimeter.

4.3.2.1.2.4 PPE.

4.3.2.1.3 Test Samples. 3 systems.

4.3.2.1.4 Test Time. 4 h.

4.3.2.1.5 Test Preparation. See 4.1.

4.3.2.1.5.1 Provide Watt Density calculations for the specific size of the windshield.

4.3.2.1.5.2 Photograph all test setups prior to running test.

4.3.2.1.6 Test Condition. See 4.2.

4.3.2.1.6.1 Voltage shall be 13.5 V unless otherwise specified in the program specific SSTS/CTS.

4.3.2.1.6.2 Confirm the test at the following conditions:

- Ambient temperature.
- +10 °C.
- 0 °C.
- -10 °C.
- -20 °C.
- -40 °C

4.3.2.1.7 Test Procedure – Watt Density.

4.3.2.1.7.1 Apply 13.5 V to the system at each environmental conditions in 4.3.2.1.6.2.

4.3.2.1.7.2 Record the Total Watt Density for the windshield.

4.3.2.1.7.3 Calculate the resistance of the system at all conditions in 4.3.2.1.6.2.

4.3.2.1.7.4 Record the Resistance in the test report.

4.3.2.1.7.5 Repeat for V_{nom} and $V_{dynamic}$ – These are program specific values.

4.3.2.1.8 Test requirements – Watt Density.

4.3.2.1.9 Confirm that the system meets 600 W/m² or program specific SSTS/CTS/VTs requirements.

4.3.2.1.10 Confirm that the system does not exceed 650 W/m² or program specific SSTS/CTS/VTs requirements.

4.3.2.2 Defrosting Performance.

4.3.2.2.1 Purpose. To determine the performance of the Defrosting capability of the heated windshield.

4.3.2.2.2 Equipment.

4.3.2.2.2.1 Thermal chamber.

4.3.2.2.2.2 Holding fixture.

4.3.2.2.2.3 Power supply.

4.3.2.2.2.4 Snow making machine.

4.3.2.2.3 Test Samples. 3 minimum.

4.3.2.2.4 Test Time. 8 h.

4.3.2.2.5 Test Preparation. See 4.1.

4.3.2.2.6 Test Conditions. See 4.2.

4.3.2.2.7 Test Procedure - Defrosting Performance.

4.3.2.2.7.1 Set up the test buck or vehicle the thermal chamber at -30 °C.

4.3.2.2.7.2 Soak for 4 h or until same is at soak temperature.

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