



Exterior Subsystems Solar Exposure 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 ensure exterior components can withstand extreme heat from simulated solar exposure and assembly plant paint repair.

1.2 Applicability. This test applies to all components mounted on the vehicle exterior are subjected to solar exposure.

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

2.3 Additional References.

- CG583 Development/Validation Test and Vehicle Review
- Subsystem Technical Specification (SSTS)

3 Resources

3.1 Facilities. An environmental chamber or test area large enough to accommodate the test vehicle and capable of maintaining the specified surface temperature.

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 Light/Heat Source. A ceiling-mounted light bank larger than the plan view area of the vehicle. The light bank should have lamps arranged in rows and columns approximately 200 mm apart center-to-center as shown in Appendix A, Figure A2. Spacing the lamps farther apart will cause uneven heating. An insufficient number of lamps will require them to be positioned too close to the test material and also cause uneven heating. The light bank must be vertically adjustable to vary the surface temperature on the test vehicle as described in Appendix B, Table B1 (see also 4.2.1).

In addition, a smaller portable light bank as demonstrated in Appendix A, Figure A1 is to be used to simulate afternoon sun and to test parts mounted on the side and front of the vehicle such as mirrors, body side moldings, assist steps and fascias.

3.2.1.1 Three (3) types of lamps are permitted as follows:

- Quartz halogen dichroic mirror lamp
- Infrared heat lamp (250 W)

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- Metal halide continuous spectrum lamp

3.2.2 Temperature Measurement. A contactless infrared pyrometer is the preferred method to monitor surface temperatures. Use thermocouples to control lamp output to the desired temperature. Thermocouples shall be placed on surfaces closest to the light/heat source. If metal halide lamps are used, a pyranometer is suggested to limit total solar radiance to 1000 W/m² (see 7.1 for more information).

3.2.3 Programmable Controller. Use a programmable controller that can monitor up to ten (10) thermocouples and is capable of cycling lamps on and off or dimming them to maintain the desired surface temperature. The controller must be able to store thermocouple readings every 5 minutes throughout testing.

The test parts must be in design position with design intent attachment method on test vehicle or test fixture installer per Master Process Document (MPD) or as described by the Design Engineer (DE) or Validation Engineer (VE).

3.3 Test Vehicle/Test Piece. The test part shall be a full vehicle or test fixture. For validation, the parts must be the production version that will be sold to customers, including attachments and must have all production released interfacing parts.

Adhesively attached parts must be evaluated with the production intent painted surface interface.

3.3.1 Shield or mask the vehicle tires from direct exposure to the infrared lamps to ensure the surface temperatures do not exceed 80 °C at any time. Verify the method is effective.

3.3.2 Painted and mold-in-color parts must be black for this test. The surface temperatures listed in the Component Test Temperature Table and Test Temperature Zone Figures are for black parts only, measured at the location normal to the light/heat source. White parts, for example, will be 25 °C to 30 °C cooler under identical conditions. Note the general color of parts tested in the test data sheets. See Appendix A, Data Sheet A1 for an example.

3.3.3 Multiple tests are necessary to expose all the vehicle parts. If required, cover or mask parts that are not on test to avoid excessive or multiple solar exposure(s).

3.4 Test Time.

Calendar time:	1 d
Test time: (solar exposure)	3 h
Coordination time:	2 h

3.5 Test Required Information. Take photographs and measurements of the parts to be tested as installed before, during and after the test. Take the photographs at the appropriate distance and angle to emphasize and make clear the gaps, flushness and parallelism of the test parts. Temperature and gap measurements must be taken during the course of the test. Also, a static review must be completed with the DE and the VE.

3.6 Personnel/Skills. Test personnel shall include the DE and the VE along with a test laboratory technician or Test Engineer.

4 Procedure

4.1 Preparation. Mark the parts with a paint pen or adhesive tape to make evident changes in length, gap or flushness. Marks shall continue from part onto vehicle body or test fixture for use as reference points. The number and precise location of these critical areas shall be determined by the DE or VE. Place thermocouples at the most normal surface to the heat lamps. The location and number of thermocouples shall be approved by the DE and VE. The test setup and specifically the length, gap and flushness measurement locations, shall be reviewed and approved by the DE and VE. If it is not feasible to review the test setup with the DE and VE onsite, a map of the measurement locations is to be created and sent to the appropriate individuals for review and approval. Prior to start of any test, the CG583 Development/Validation Test and Vehicle Review form must be signed by the DE, VE and Test Engineer.

4.2 Conditions.

4.2.1 Environmental Conditions. See the Global Subsystem Technical Specification (SSTS) or respective requirements document and Appendix B, Figure B1 for detailed environmental conditions and requirements that drive the location and orientation of light/heat source(s).

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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.

The DE and VE shall agree on any deviations from this standard. The deviations shall be detailed in the test report.

4.3 Instructions.

4.3.1 Airflow. Place vehicle or test fixture in the test area at ambient temperature, $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, with minimal airflow directly underneath the lamps. Airflow creates convective cooling on the part surface which causes the controller to drive excessive heat into the parts. If necessary, erect temporary panels to shield the test property from ventilation airflow in the test area.

4.3.2 Open and Close Closure Panels Pre-Test. Prior to start of test, open and close all closure panels to confirm there is no interference conditions between exterior components mounted on closures and adjacent panels.

4.3.3 Applying Radiant Heat. Apply radiant heat using the test temperature profile in Figure 1 until the part's surface temperature, normal to the light/heat source, achieves the specified value as stated in the SSTS or respective requirements document or, as noted in Appendix B, Table B1. For parts with curved surfaces, this is always the point closest to the lamp source. For components mounted on the side of the vehicle, use a portable bank of lamps angled 35 degrees to 45 degrees from horizontal and placed to the vehicle's side. See Appendix A, Figure A1. Do not angle lamps at larger angles to horizontal to apply heat to the vehicle. Actual sun load rapidly decreases at larger angles.

Position the light/heat source as far from the vehicle as possible while still being able to attain the specified surface temperature to avoid localized overheated zones. A distance of 0.8 m to 1.0 m is a practical minimum.

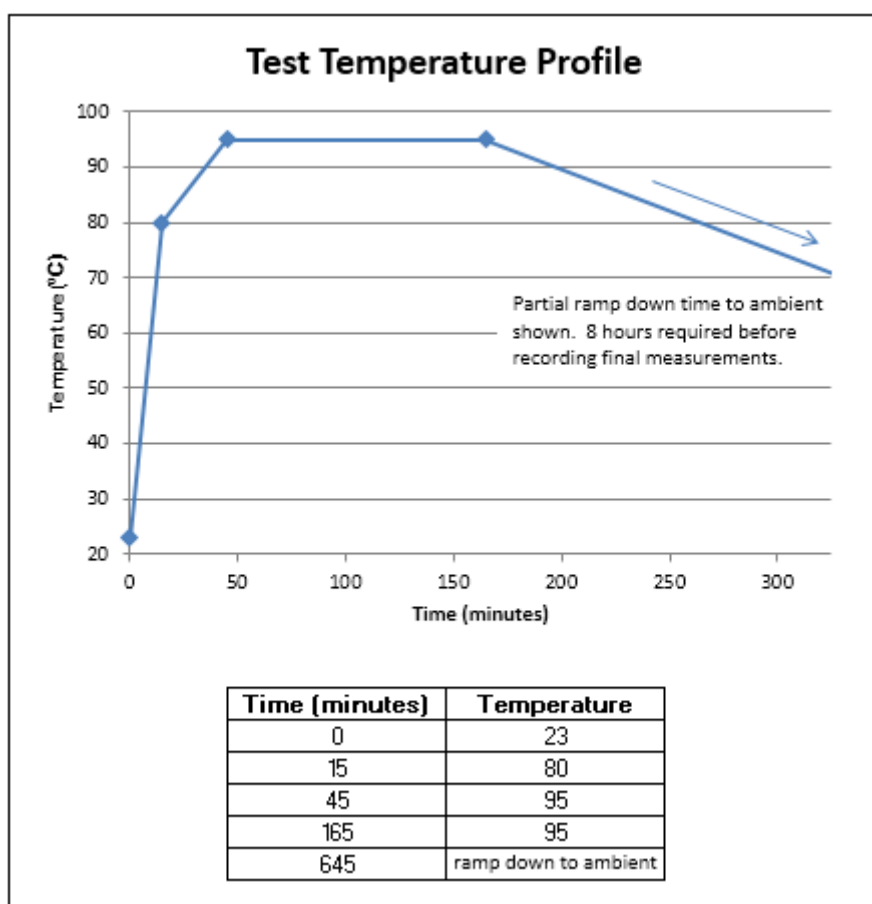


Figure 1: Test Temperature Profile

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