



Sunshade Module 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. This standard defines the testing methodology and requirements for validating Sunshade Module systems to GM requirements. Sunshade Module system components include Sunshade Module motor/transmission, Sunshade Module Electrical components and connections; guide rails and fabric as well as any attaching hardware.

1.2 Applicability. This standard applies to all passenger cars, Multipurpose Passenger Vehicles (MPV), and trucks that have a Sunshade Module system.

1.3 Remarks. This document is the GM Worldwide Sunshade Module Testing Standard. Its purpose is to establish a common test methodology for Sunshade Module 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 Roof Closure 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	GMW8518	GMW14529 (ID)	GMW15443
GMW3091	GMW14153	GMW14650	GMW15576
GMW3172	GMW14155	GMW15016	GMW15730
GMW3600	GMW14264	GMW15264	GMW15760
GMW8463	GMW14444	GMW15308	

(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 R&D Report AS-598 (ID)
- GM Security Guidelines (<https://gmweb.gm.com/HR/Security/Pages/FutureGuide.aspx>)
- Program Specific Component Technical Specification (CTS)
- Program Specific Subsystem Technical Specification (SSTS)
- Statement of Requirements (SOR), Appendix B
- Vehicle Technical Specifications (VTS) (ID)

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.

3.1.1.1 See Calibration Sheet, Appendix C, Data Sheet C1.

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 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.

3.2.3 Fixtures. Body test buck consisting of Body-In-White (BIW).

3.2.4 Power Supply. Electrical power supply device that reflects vehicle electrical interface (mating connector, wire gage, control box, etc.)

3.2.5 Digital camera.

3.2.6 Force gauge with hook attachment.

3.2.7 Electric motor dynamometer.

3.2.8 Output shaft holding fixture.

3.2.9 Measuring scale/ruler.

3.2.10 Cycle counter/encoder.

3.2.11 Oscilloscope.

3.2.12 Temperature measuring equipment.

3.2.13 Accelerometer.

3.2.14 Shipping Containers/Carton.

3.2.15 Vibration/Shock Machine. Electromagnetic oscillation table with control unit for oscillation test.

3.2.16 Wire Harness. Wiring harness capable of running the Sunshade Module system from outside the vehicle/buck.

3.2.17 Vehicle.

3.3 Test Vehicle/Test Piece.

3.3.1 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.

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

3.3.3 Unless otherwise specified, Six (6) samples of components or systems shall be tested.

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

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

3.3.6 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.

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

3.4 Test Time. Time is dependent on test being performed. See specific GMW Instruction for test time.

3.5 Test Required Information.

3.5.1 Notification. GM Validation shall be notified of test failures within 24 h period of occurrence.

3.5.2 Five (5) Phase. Supplier to develop 5 phase document (see CG180 in 2.3) for all test failures. **The 5-Phase document shall be submitted within 48 h of test failure.**

3.5.3 Product Security. Security protocol for the test vehicle must be followed per GM Security Guidelines.

3.6 Personnel/Skills.

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.

3.6.1.3 Prior experience in setting up and running similar tests. Experience in the use of the referenced test equipment.

4 Procedure

4.1 Preparation.

- Function. If the system has not been previously cycled, cycle Sunshade Module system, without interruption, to full open and full closed a minimum of five (5) times prior to the start of test to assure proper operation and seating of all system components. At Troom, apply power to the Sunshade module system motors at voltage Vnom through the production connector. Cycle speeds of the Sunshade, shall meet the specifications in the program specific SSTS/CTS Measurement of speed shall be taken from the point of current initialization to peak stall current in each movement direction. Record speed in test report per direction in individual test methods. Additionally, operate as described in this section and visually evaluate the system for interference of system components.
- Read the proper requirement from the Subsystem Technical Specification (SSTS) and this GMW thoroughly.
- Ensure that proper Personal Protection Equipment is used during set up and testing.
- Ensure that the materials are in compliance to GMW3059 and any regulatory requirements for country of sales.
- 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.)
- Refer to Appendix A, Figure A1 and Figure A2 to understand the test sequencing for all test samples included in this procedure. This is only a suggested test flow to help optimize test samples.
- This standard has been developed to reflect customer usage for markets which have developed road systems (more stable road systems and lesser amounts of unpaved and rough roads). Other regional or local requirements may necessitate additional test options. For further information, consult regional Engineering Center.
- 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.)
- 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.

- Ensure that all torques have been confirmed before test.
- Ensure that all critical Bolts have been marked before test.
- Ensure that the fixture is in proper working order – proper representation of the body, no damage from previous test.
- Ensure that all equipment is in proper working order, equipment is calibrated, counters are working properly.
- Document environmental conditions (Temperature, humidity, time and date), before start, during and end of test.

4.2 Conditions.

4.2.1 Environmental Conditions. Actual requirement values for the symbols shall be obtained from the Subsystem Technical Specification (SSTS) or the respective specification and recorded on Appendix B of the SOR.

The driving test can be performed in all types of weather. However, in situations where severe weather makes certain driving maneuvers unsafe, Test Procedure Subsections using those maneuvers shall be postponed until road conditions improve.

The following conditions apply to all tests unless otherwise specified in the program specific SSTS/CTS:

- Ambient temperature: $(+23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C})$.
- Voltage: $V_{\text{nom}} \pm 0.3\text{ V}$ at motor terminals.
- Humidity shall be $(40\% +20\%)$ or all tests unless otherwise specified.
- T_{min} is $-40\text{ }^{\circ}\text{C}$ unless otherwise specified.
- T_{max} is $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.
- 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.

4.2.2.1 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.

Deviations from the requirements of this standard shall have been agreed upon between GM Subsystem Validation Engineer (SVE) and/or DE and the supplier. Such requirements shall be specified on component drawings, test certificates, reports, etc. Deviations shall be approved by the GM Validation Engineer and specified on the G3 Analysis Development and Validation Plan and Report and all effected test reports. The deviations to SSTS/VTs requirements shall be documented with the DE.

4.2.2.2 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. Check for cracks, paint chips, dents, etc., and document for comparison to post-test observations (see 4.3.3.2).

4.2.2.3 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).

4.2.3 Facilities and Equipment Preparation. Record the instrumentation calibration information on the attached Calibration Appendix C, Data Sheet C1 or an equivalent document.

4.2.4 Dynamic Torques. Unless otherwise specified, use a dynamic gun at 50 rpm to dynamically torque the nuts for all tests.

4.2.5 Part Orientation. Parts shall be tested in vehicle orientation unless otherwise specified in the program specific SSTS/CTS.

4.2.6 Water Hardness. Verify that the hardness of the water does not exceed 205 mg/l (Twelve (12) grains per gal). The water hardness certification may be obtained from the local water supplier. Otherwise, contractor shall obtain an equivalent certification or conduct such test within 60 d beginning of compliance test run. A suitable water softener shall be used if required.

4.2.7 Fastener. Nominal fastener torques are to be used unless otherwise specified in the program specific SSTS/CTS.

4.2.8 Test Velocity. The Sunshade Module System shall be pulled at a rate of 50 mm/minute until there is separation between the Sunshade inner and outer.

4.2.9 Emerging Market Environmental Conditions.

Emerging Markets are to use the following unless stated otherwise in the program specific SSTS.

- Tmin = -20 °C for India.
- Tmin = -40 °C for Russia.
- Tmin = -15 °C for South America Only.

4.3 Instructions.

4.3.1 Sunshade Module System Electronic Component Specification Testing.

4.3.1.1 Purpose. To verify the environmental and durability performance of electronic components in the Sunshade Module system meet program specific SSTS/CTS requirements.

4.3.1.2 Equipment. Reference GMW3172.

4.3.1.3 Sample Size. Samples of each electronic component as specified in the procedure (includes drive motors, electronic control units, integral switches, etc.)

4.3.1.4 Test Time. Refer to GMW3172.

4.3.1.5 Test Preparation. See 4.1.

4.3.1.6 Test Conditions. See 4.2.

4.3.1.7 Procedure. Test to GMW3172. Approval of a Component Environmental Test (CEMENT) Plan for each electronic device is required.

4.3.1.8 Acceptance Criteria. Samples shall pass post-test requirements as defined in the Component Environmental Test Plan, per requirements defined in the SSTS or the respective specification. Record all results per GMW3172.

4.3.2 Sunshade Module System Ultra Violet (UV) Exposure Testing.

4.3.2.1 Purpose. To determine if the Sunshade Module subsystem will incur damage when subjected to simulated sunlight, heat, and moisture.

4.3.2.2 Equipment. Reference 3.2.

4.3.2.3 Sample Size. Samples of each component as specified in the procedure. Samples are to be plaque-sized sections cut from a production representative or production Sunshade Module system, containing the interface to be tested. One (1) sample of each condition outlined in the noted procedures is to be tested.

4.3.2.4 Test Time. Dependent on materials.

Calendar time: 105 d

Test time: 2500 h

Coordination time: 20 h

4.3.2.5 Test Preparation. See 4.1.

4.3.2.6 Test Conditions. See 4.2.

4.3.2.7 Procedure. Test to GMW14650, and/or GMW14444 as noted in the program specific SSTS/CTS.

4.3.2.8 Acceptance Criteria. Samples shall meet requirements as defined in the SSTS or other respective specification.

4.3.2.8.1 Record All Results in an independent test report per GMW or other noted procedures.

4.3.3 Sound Quality Determination.

4.3.3.1 Purpose. To evaluate the noise of a power Sunshade Module system when mounted on a fixture.

4.3.3.2 Equipment. Reference GMW14153.

4.3.3.3 Sample Size. Durability and Reliability samples may be used to fulfill requirement or, test three (3) new 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 Procedure.** Test to GMW14153.

4.3.3.8 Acceptance Criteria. Samples shall meet requirements as defined in the SSTs or other respective specification.

4.3.3.9 Record All Results in an independent test report per GMW14153.

4.3.4 Sunshade Module Noise Avoidance.

4.3.4.1 Purpose. To identify the vehicle modals and apply the frequencies to a Sunshade development test to verify that the vehicle modal does not cause the Sunshade to vibrate creating objectionable noises.

4.3.4.2 Test Equipment.

4.3.4.2.1 Test Room/Sound room. Reference GMW14155.

4.3.4.2.2 Use a fixture with design intent structure to mount the Sunshade Module in vehicle position using design intent attachments.

4.3.4.2.3 Microphone. Details given in Master Procedure GMW14155.

4.3.4.3 Test Samples. Unless otherwise specified six (6) samples are to be used.

4.3.4.4 Test Time.

Calendar time: 1 d to 2 d

Test time: 1 h to 2 h

Coordination time: 1 h to 2 h

4.3.4.5 Test Preparation.

4.3.4.6 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.

4.3.4.6.1 Environmental Conditions.

Test shall be performed under the following environmental conditions:

Test Temperature: Humidity.

- a. Ambient = 5%
- b. Ambient = 95%
- c. Cold (-40C) = 5%
- d. Cold (-40C) = 95%
- e. Hot (95C) = 5%
- f. Hot (95C) = 95%

4.3.4.7 Test Procedure.

4.3.4.7.1 Record the sound while operating the Sunshade module in each mode of operation in accordance with Master Procedure GMW14155.

4.3.4.7.2 Analyze the sounds of each mode of operation as given in Master Procedure GMW14155 for impulsive overall loudness (start and stop), steady-state loudness, warble, steady state specific loudness and relative pitch.

4.3.4.8 Test Requirements or Acceptance Criteria.

- Must meet the program specific requirements in the CTS/SSTs.
- Photographs of test setup.

- Photographs of the test samples before and after testing.

4.3.5 Motor Stall/Thermal Trip.

4.3.5.1 Purpose. The purpose of this test is to verify that the Sunshade Module motor will not be damaged if the Sunshade Module system is activated with an obstruction and not able to move for an extended period of time.

4.3.5.2 Test Equipment. See 3.3.4.

4.3.5.2.1 Electric motor dynamometer.

4.3.5.2.2 Output shaft holding fixture.

4.3.5.3 Test Samples. Two (2) motors.

4.3.5.4 Test Time.

Calendar time: 1 d

Test time: 8 h

Coordination time: 2 h

4.3.5.5 Test Preparation. See 4.1.

4.3.5.6 Test Conditions. See 4.2.

4.3.5.7 Test Condition.

- $(-30\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C})$
- $(+80\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C})$

4.3.5.8 Test Procedure. Prior to test, subjectively evaluate the system noise (including but not limited to whine, growl, clicks, clunks, etc.) per Subjective Rating Scale for Component Noise in GMW14264 under the following conditions: Vnom, no load.

4.3.5.8.1 Mount each motor to a dynamometer and run at Vnom with a 2.5 Nm constant load for 30 minutes. After warm up period, obtain motor performance via a speed-torque curve from free speed to stall. Allow motors to cool for 1 h before start of test.

4.3.5.8.2 Place first motor sample in holding fixture with output shaft restricted.

4.3.5.8.3 Condition. Soak motor at $(-30\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C})$ for 4 h.

4.3.5.8.4 At $(-30\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C})$, energize restricted motor in high speed for 3 h.

4.3.5.8.5 De-energize motor and continue to soak at $(-30\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C})$ for additional 2 h.

4.3.5.8.6 At $(-30\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C})$ energize restricted motor in low speed for 3 h.

4.3.5.8.7 Repeat 4.3.5.8.1 through 4.3.5.8.6 on second motor sample except change thermal temperature to $(+80\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C})$.

4.3.5.8.8 Upon completion of stall conditions, allow for cool-down period of at least 4 h. After cool-down period, record motor performance via a speed-torque curve from free speed to stall.

4.3.5.8.9 Motor noise Evaluation: Repeat motor noise evaluation described in 4.3.6.6 on both motors.

4.3.5.9 Test Requirement. Both high and low Sunshade Module motor speeds with 2.5 Nm load shall not degrade more than 10% from initial speed OR torque as specified in the program specific SSTs.

4.3.5.9.1 Sunshade Module motor low speed stall torque shall not degrade more than 10% from design torque OR speed as specified in the program specific SSTs.

4.3.5.9.2 Sunshade Module motor current draw for both low and high speeds shall be within design specification. Document the current draw under all conditions.

4.3.5.9.3 Initial motor noise Subjective Rating shall be nine (9) or better and after testing it shall be eight (8) or better. Check the program specific SSTs/VTS for additional requirements.

4.3.6 Durability/Reliability.

4.3.6.1 Purpose. The purpose of this test is to verify a Sunshade Module system will meet specified performance requirements during a vehicle's lifetime with reliability and confidence level of Reliability of 95% with a 50% Confidence (R95C50) at one (1) life. One (1) life is defined in program SSTs.

4.3.6.2 Test Equipment. See 3.3.4.

4.3.6.2.1 Cycle Counter/Encoder.**4.3.6.2.2 Oscilloscope.****4.3.6.2.3 Thermal Chamber.****4.3.6.3 Test Samples.** See 3.3.5, three (3) samples minimum.**4.3.6.4 Test Time.** Depends on the program specific requirement from the SSTs.

Calendar time: 42 d

Test time: 1000 h

Coordination time: 16 h

4.3.6.5 Test Preparation. See 4.1.**4.3.6.6 Test Conditions.** See 4.2.

4.3.6.6.1 If GM validation engineer is not available to view test, provide video recording showing test setup and initial system operation.

4.3.6.6.2 Reliability requirement can be met through either Success or Failure testing. Review with GM Validation Engineer and get agreement on which method will be used before start of test.

4.3.6.6.2.1 Failure Test. Required unless specifically stated in the program specific SSTs for DV Testing. Repeat durability test profile, until a failure defined in Test Requirements is detected. Analyze the resulting failure data using a Weibull probability plot to estimate the reliability. The estimate shall be R95C50 or better at one (1) life. Deviations to this must have Approval by the GM SVE and DE for the program.

Note: A Beta slope of 1.5 shall be used as a default and for new suppliers or new designs. The value can be increased based on the following:

- Experienced Supplier.
- Similar Designed Systems with historical data (Carryover motor, carryover linkage, etc.)
- AND** Approval by the SVE and DE for the program.

Supplier shall notify SVE and DE of the Beta slope used and whether Success or Failure test Method will be used prior to start of any testing.

Table 1: Reliability 95% with 50% Confidence

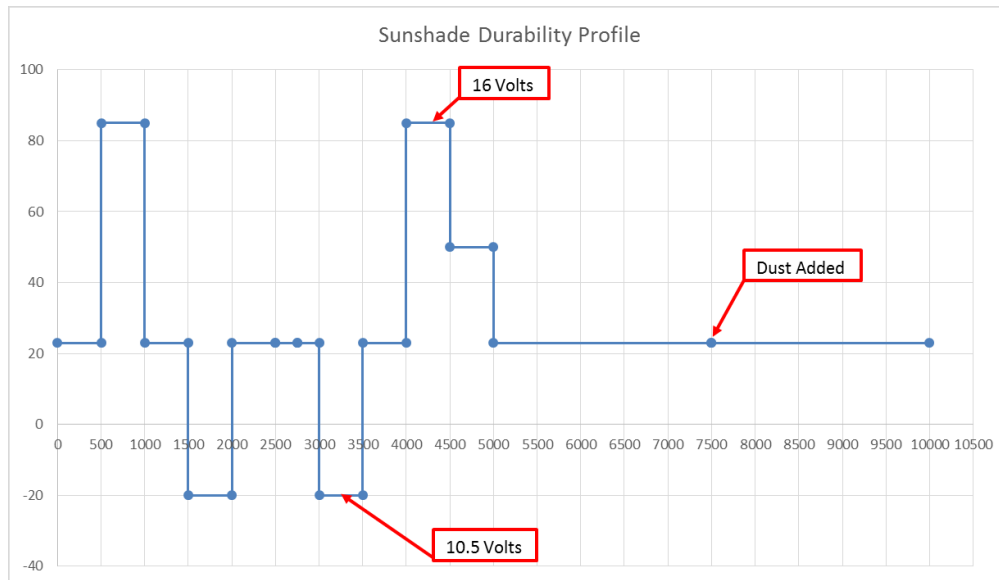
R95C50 Chart Using Beta = 1.5	
Sample Size	Number of Life Cycles
3	2.73
6	1.72
R95C50 Chart Using Beta = 2.0	
Sample Size	Number of Life Cycles
3	2.12
6	1.50
R95C50 Chart Using Beta = 3.0	
Sample Size	Number of Life Cycles
3	1.65
6	1.31

4.3.6.6.2 Success Test. Recommended for PV Testing if test to failure was used during DV. Table 1 provides direction for required test duration with three (3) samples. Repeat durability test profile, until life cycles have been run without failure. See 4.3.7.7 for definition of failure.

4.3.6.7 Test Condition. See specific procedure.

4.3.6.8 Test Procedure. Prior to test, subjectively evaluate the Sunshade Module noise (including but not limited to whine, growl, clicks, clunks, etc.) per Subjective Rating Scale for Component Noise in GMW14264 under the following conditions: Vnom, Record current draw, and conduct durability/reliability test using Sunshade Module durability test profile in Figure 1. Verification of system operation and data monitoring equipment shall be done at least twice a day.

Figure 1: Front Sunshade Module Durability Profile for Passenger Vehicles



4.3.6.8.1 Cycle is defined as open and closing of the Sunshade.

4.3.6.8.2 Place the fixture into the thermal chamber and allow to soak for 2 h before each of the different environmental conditions.

4.3.6.8.3 Ensure that the fixture holds the Sunshade module system in vehicle orientation.

4.3.6.8.4 During durability/reliability test, collect the following data as specified.

4.3.6.8.4.1 Record the following data every 1000 cycles: Cycle Time – Open and close, current draw.

4.3.6.8.4.2 Record the following data every 500 cycles: Cycle Time – Open and close, appearance issues, evaluate noises.

4.3.6.8.5 At the end of one (1) life cycle durability: Operate system in ambient condition and verify no system failures occurred according to test requirements.

4.3.6.8.6 Continue test until reliability tests are complete. Contact GM Validation Engineer and perform Design Review Based on Test Results (DRBTR) analysis.

4.3.6.9 Test Requirement.

4.3.6.9.1

4.3.6.9.1.1 Definition of system failure during first life cycle.

4.3.6.9.1.2 Open/close speed does not meet design requirements.

4.3.6.9.1.3 Current draw exceeds design specification.

4.3.6.9.1.4 Motor Noise Subjective Rating is < 8.

4.3.6.9.1.5 No water shall be allowed in the connector or in the motor.

4.3.6.9.1.6 No visible corrosion is allowed on the connector or in the motor.

4.3.6.9.2 Definition of system failure after first life cycle is the same as during first life cycle except:

- Open/close changes > 15% from original measured data.
- Motor noise Subjective Rating is < 6.
- No water is allowed to be inside the motor – Teardown required.
- No water shall be allowed in the connector – Teardown required.
- No visible corrosion is allowed on or in the connector nor in the motor.

4.3.7 Hot Temperature Operation.

4.3.7.1 Purpose. The purpose of this test is to confirm that a Sunshade Module system is capable of functioning properly at the maximum temperature specified in the SSTs.

4.3.7.2 Test Equipment. See 3.3.4.

4.3.7.2.1 Sunshade Module holding fixture.

4.3.7.3 Test Samples. Three (3) systems.

4.3.7.4 Test Time.

Calendar time: 1 d

Test time: 6 h

Coordination time: 2 h

4.3.7.5 Test Preparation. See 4.1.

4.3.7.6 Test Conditions. See 4.2.

4.3.7.6.1 Temperature. Maximum (Tmax) temperature for each vehicle needs to be defined by GM Thermal Development Engineer or from the specific program team.

4.3.7.7 Test Condition. See 3.3.

- Tmax temperature.

4.3.7.8 Test Procedure. Prior to test, subjectively evaluate the system noise (including but not limited to whine, growl, clicks, clunks, etc.) per Subjective Rating Scale for Component Noise in GMW14264 under the following conditions: Vnom, low and high speed, wet glass.

4.3.7.8.1 Condition. Mount Sunshade Module system in test buck and soak at $T_{max} \pm 3^{\circ}\text{C}$ for 4 h in environmental chamber.

4.3.7.8.2 While at $T_{max} \pm 3^{\circ}\text{C}$, operate system and record cycles per minute for the following settings:

- V_{nom} , low speed and high speed.
- 9.0 V, low speed and high speed.
- 16.0 V, low speed and high speed.

4.3.7.8.3 Continue to operate system on high speed for 30 minutes. After 30 minutes stop Sunshade Module system and set chamber temperature to $(+23^{\circ}\text{C} \pm 3^{\circ}\text{C})$ for 4 h.

4.3.7.8.4 Repeat the motor noise evaluation as described in 4.3.8.6.

4.3.7.9 Test Requirement. The following items shall be within design specification after testing and the system has stabilized to ambient conditions, and current draw.

4.3.7.9.1 Motor Noise Evaluation: Subjective Rating prior to test shall be nine (9) or better and after testing it shall be eight (8) or better.

4.3.8 Cold Temperature Operation.

4.3.8.1 Purpose. The purpose of this test is to confirm that a Sunshade Module system is capable of functioning properly at the minimum temperature specified in the SSTs.

4.3.8.2 Test Equipment. See 3.3.4.

4.3.8.3 Test Samples. Three (3) Sunshade Module systems.

4.3.8.4 Test Time.

Calendar time: 5 d

Test time: 100 h

Coordination time: 4 h

4.3.8.5 Test Preparation. See 4.1.

4.3.8.6 Test Conditions. See 4.2.

4.3.8.6.1 Temperature. Minimum (T_{min}) temperature for each vehicle needs to be defined by GM Thermal Development Engineer.

4.3.8.7 Test Condition. See 3.3.

- Temperature minimum (T_{min}).

4.3.8.8 Test Procedure. Prior to test, subjectively evaluate the Sunshade Module system noise (including but not limited to whine, growl, clicks, clunks, etc.) per Subjective Rating Scale for Component Noise in GMW14264 under the following conditions: V_{nom}

4.3.8.8.1 Mount Sunshade Module system in test buck. Soak at $T_{min} \pm 3^{\circ}\text{C}$ for 4 h in environmental chamber.

4.3.8.8.2 While at $T_{min} \pm 3^{\circ}\text{C}$, operate system and record cycles per minute for the following settings:

- V_{nom} , low speed and high speed.
- 9.0 V, low speed and high speed.
- 16.0 V, low speed and high speed.

4.3.8.8.3 Continue to operate system on high speed for 30 minutes at V_{nom} (Default is 13.5 V). After 30 minutes stop Sunshade Module system and set chamber temperature to $(+23^{\circ}\text{C} \pm 3^{\circ}\text{C})$ for 4 h.

4.3.8.8.4 Repeat the motor noise evaluation as described in 4.3.9.6.

4.3.8.9 Test Requirement. The following items shall be within design specification after testing and the system has stabilized to ambient conditions, and current draw.

4.3.8.9.1 Motor Noise Evaluation: Subjective Rating prior to test shall be nine (9) or better and after testing it shall be eight (8) or better.

4.3.9 Hot Storage Testing.

4.3.9.1 Purpose. The purpose of this test is to verify that if the Sunshade Module system is stored in a location which has high ambient temperatures it will not have any lasting effect on the Sunshade Module system's performance.

4.3.9.2 Test Equipment. See 3.3.4.

4.3.9.3 Test Samples. See 3.3.5, three (3) Sunshade Module systems.

4.3.9.4 Test Time.

Calendar time: 5 d
Test time: 100 h
Coordination time: 2 h

4.3.9.5 Test Preparation. See 4.1.

4.3.9.6 Test Conditions. See 4.2.

4.3.9.7 Test Condition. See 3.3.

- Temperature: (+90 °C ± 3 °C)

4.3.9.8 Test Procedure. Prior to test, the test engineer shall subjectively evaluate the motor noise (including but not limited to whine, growl, clicks, clunks, etc.) per Subjective Rating Scale for Component Noise in GMW14264 to evaluate type of sounds under the following conditions: Vnom, low and high speed, no load. These statements will appear in the procedures:

- The evaluation shall be performed in a quiet room, however, if the quiet room is not available, the Evaluator shall give the rating as if the item was heard in a quiet room with respect to noise levels.
- It is understood that the rating is for the sound performance of that specific item type (example: side door closed); not a rating amidst a general category of items. (Example: all body closures).

4.3.9.8.1 Condition. Place Sunshade Module system parts in an environmental chamber and set temperature to (+90 °C ± 3 °C). Part orientation should represent shipping package orientation if known. A fixture may be required to hold components in shipping position. If shipping package has not been developed at DV, use the Engineering Evaluation to determine the appropriate orientation. This shall be agreed upon by the GM SVE and Design Release Engineer (DRE). Maintain temperature for 100 h.

4.3.9.8.2 Reduce temperature to (+23 °C ± 3 °C) for 4 h to allow Sunshade Module components to stabilize.

4.3.9.8.3 Evaluate. Install parts on test buck (use parts from storage) and operate to verify test requirements.

4.3.9.8.4 Motor Noise Evaluation. Repeat motor noise evaluation as described in 4.3.9.8 with the same test engineer.

4.3.9.9 Test Requirements. The following items shall be within design specification after testing: See program specific SSTs for required specifications to be checked, water protection per SSTs (run thru leak test and do DRBTR at the end of test leg).

4.3.9.9.1 See program specific SSTs for current draw. Document all results in the test report.

4.3.9.9.2 Motor Noise Evaluation: Subjective Rating prior to test shall not have a degradation after testing.

4.3.10 Cold Storage Testing.

4.3.10.1 Purpose. This test is to verify that if the Sunshade Module system is stored in a location which has low ambient temperatures, it will not have any lasting effect on the Sunshade Module system's performance.

4.3.10.2 Test Equipment. See 3.3.4.

4.3.10.3 Test Samples. See 3.3.5, three (3) Sunshade Module systems.

4.3.10.4 Test Time.

Calendar time: 5 d
Test time: 100 h
Coordination time: 8 h

4.3.10.5 Test Preparation. See 4.1.

4.3.10.6 Test Conditions. See 4.2.

4.3.10.7 Test Condition. See 3.3.

- Temperature: $(-40\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C})$

4.3.10.8 Test Procedure.

4.3.10.8.1 Prior to test, the test engineer shall subjectively evaluate the motor noise (including but not limited to whine, growl, clicks, clunks, etc.) per Subjective Rating Scale for Component Noise in GMW14264 (evaluate type of sounds) under the following conditions: Vnom, and -30 °C environmental.

- The evaluation shall be performed in a quiet room, however, if the quiet room is not available, the Evaluator shall give the rating as if the item was heard in a quiet room with respect to noise levels.
- It is understood that the rating is for the sound performance of that specific item type (example: side door closed); not a rating amidst a general category of items. (Example: all body closures).

4.3.10.8.2 Condition. Place Sunshade Module system parts in an environmental chamber and set temperature to $(-40\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C})$. Part orientation should represent shipping package orientation, if known. A fixture may be required to hold components in shipping position. Maintain temperature for 100 h.

4.3.10.8.3 Increase temperature to $(+23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C})$ for 4 h to allow Sunshade Module components to stabilize.

4.3.10.8.4 Evaluate. Install parts on test buck and operate to verify test requirements.

4.3.10.8.5 Motor Noise Evaluation. Repeat motor noise evaluation as described in 4.3.10.8.1 through 4.3.10.8.4 with the same test engineer.

4.3.10.9 Test Requirements. The following items must be within design specification after testing: open/close speed, customer actuated sound levels, current draw. Document all results in the test report.

4.3.10.9.1 Motor Noise Evaluation. Subjective Rating prior to test shall be nine (9) or better.

4.3.11 Free Fall.

4.3.11.1 Purpose. This test is to ensure that if a Sunshade Module system is dropped during vehicle assembly that the part will be noticeably damaged and be discarded or if no damage is visible that the part will pass all functional requirements.

4.3.11.2 Test Equipment. See 3.3.4.

4.3.11.3 Test Samples. See 3.3.5, three (3) Sunshade Module systems.

4.3.11.4 Test Time.

Calendar time: 1 d

Test time: 1 h

Coordination time: 1 h

4.3.11.5 Test Preparation. See 4.1.

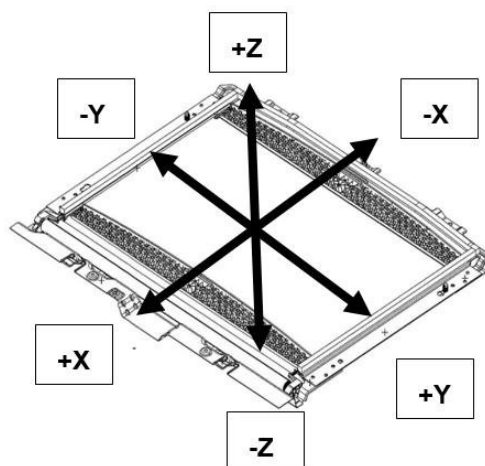
4.3.11.6 Test Conditions. See 4.2.

4.3.11.7 Test Condition. See 3.3.

4.3.11.8 Test Procedure. Prior to test, subjectively evaluate the system noise (including but not limited to whine, growl, clicks, clunks, etc.) per Subjective Rating Scale for Component Noise in GMW14264 under the following conditions: Vnom, low and high speed, no load.

4.3.11.8.1 Use Figure 2 to define X, Y, and Z axis for the Sunshade Module system.

Figure 2: Sunshade Module System Axis



Note: No pass fail – just observation.

4.3.11.8.2 X-axis. With the 1st sample drop the system in the X-axis from a height of 1 m onto a flat concrete surface. Repeat the drop with the same system but in the opposite X direction.

4.3.11.8.3 Y-axis. With the 2nd sample drop the system in the Y axis from a height of 1 m onto a flat concrete surface. Repeat the drop with the same system but in the opposite Y direction.

4.3.11.8.4 Z-axis. With the 3rd sample drop the system in the Z-axis from a height of 1 m onto a flat concrete surface. Repeat the drop with the same system but in the opposite Z direction.

4.3.11.8.5 Inspection. Inspect all systems after test and verify test requirements.

4.3.11.8.6 Motor Noise Evaluation. Install system in test buck and repeat the system noise evaluation as described in 4.3.11.8.

4.3.11.9 Test Requirement. From any dropping direction, external damage to the Sunshade Module system shall be visible when viewing from 300 mm or greater. Document the damage as observations on the test report.

4.3.11.9.1 If there is no visible external damage, the part shall meet the following design specifications current draw, and any other specifications in the program specific SSTs. Observe for any objectionable.

4.3.12 Mechanical Shock (Pothole).

4.3.12.1 Purpose. This test is to ensure that during the life of the vehicle the Sunshade Module System will not be damaged when the vehicle hits a pothole.

4.3.12.2 Test Equipment.

4.3.12.2.1 Sunshade Module system holding fixture > 250 Hz resonance. The fixture is to represent vehicle position, vehicle structure (simulate rigidity based on Computer Aided Engineering (CAE) analysis provided by GM) and production fasteners shall be used. Fasteners shall be scribed to ensure no loss of torque.

Note: If CAE Analysis is not available use the target of > 250 Hz.

4.3.12.2.2 Accelerometer.

4.3.12.2.3 Vibration/Shock Machine.

4.3.12.2.4 Digital Camera.

4.3.12.3 Test Samples. Three (3) Sunshade Module systems.

4.3.12.4 Test Time.

4.3.12.5 Test Preparation. See 4.1.

4.3.12.6 Test Conditions. See 4.2.

4.3.12.7 Test Condition. See 3.3.