



Interior Illumination

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 define the interior lighting illumination and uniformity test procedure. This procedure should be used to verify the illumination performance is being met at a vehicle level. This procedure can also be used for competitive review or benchmarking in a vehicle setting as described in the procedure.

1.2 Applicability. This document defines the conditions and test procedures to conduct a vehicle interior lighting illumination assessment. This is used to measure light intensity and uniformity of the interior lamp assemblies.

1.3 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14118

2.3 Additional References.

- CG5857 Illumination Results Data Sheet and Checklist
- Engineering Work Order (EWO)

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.

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.

3.1.3 Darkness. Assessment should be run in an area where all other light sources may be turned off or adjusted so that other light sources will not interfere with the lighting assessment.

3.1.4 Ventilation. Some tests must be run with the vehicle on, in which case there must be a way to dispose of the fumes that are coming from the exhaust pipe.

3.2 Equipment.

3.2.1 Illuminance Meter. The device should have cosine correction or be able to read light at angles not just perpendicular to the meter.

3.2.2 Focus Lighting Circle. A 300 mm circle used to measure lighting performance of reading lamps. See 7.1 for definition.

3.2.3 Stray Lighting Circle. A 500 mm board used to measure stray light from the map/reading lamps. See 7.1 for definition.

3.2.4 Seat Fixture. A rigid fixture that will position the lighting circles per the target area for the reading lamp being evaluated.

3.2.5 Templates. The cloth templates represent the footwell, courtesy, trunk and cargo target areas, and are used in a vehicle assessment.

3.2.6 User Manual. An Owner's User Manual or representative fixture to be used at Glove Box assessment.

3.2.7 Battery Charger. If the voltage of the vehicle is not at the desired level it may be necessary to attach a battery charger to the vehicle prior to or while running the test.

3.2.8 Data Collection Sheets. All measurements are to be recorded on the data sheets in Appendix B, Data Sheet B1.

3.3 Test Vehicle/Test Piece.

3.3.1 Vehicle. In-vehicle assessments shall only be performed in production intent vehicle environments. All vehicle features that enable interior illumination shall be functional. All adjustable seats shall be functional. Ideally, measurements should be performed on the lightest and darkest trim colors of a vehicle interior to document any variation.

3.4 Test Time.

Calendar time: ½ to 1 d

Test time: (2 to 3) h

Coordination time: (½ to 1) h

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. This test requires a minimum of one person to run the assessment. All people involved with obtaining lighting measurements shall be dressed in black lab coat and black gloves to reduce variation in the lighting measurements. For vehicle evaluations, it is preferred that the lead program interior subsystem validation engineer and lamp design release engineer be present.

4 Procedure

4.1 Preparation. A vehicle and suitable location need to be reserved. Notice should be given to all participants to confirm test date and time, as well as location. Data sheets shall be provided to participants to document results.

4.2 Conditions.

4.2.1 Environmental Conditions. Dark room is required.

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. **Note:** Deviations shall have been agreed PRIOR to TESTING and documented, Engineering Work Order (EWO), etc.

4.3 Instructions.

Note: See Table 1 for voltage requirements to run tests.

Table 1: Voltage Requirements

Voltage	Test
13.5 V $\pm$ 0.1 V (this voltage is equivalent to having the engine of the vehicle on)	Reading Lamp
	Vanity Lighting
	Ambient Lighting
12.5 V $\pm$ 0.1 V (this voltage is equivalent to a vehicle with the engine off)	Courtesy Lighting
	Footwell Lighting
	Door Entry/Exit Lighting
	Rear Puddle Lighting
	Glove Box/Storage Compartment Bin Lighting
	Trunk Lighting
	Cargo Lighting

4.3.1 Reading Lamp. See Appendix A, Figure A1 for targeting details. The only lamp that should be on is the one being measured. Adjust the seats so that the seat fixture can locate the center of the lighting circles 350 mm $\pm$ 12 mm above the H-point and 350 mm $\pm$ 12 mm forward of the H-point. The circles shall be at an angle of 35 degrees off horizontal towards the occupant. The seat cushion angle shall be set at design nominal or 25 degrees from horizontal, when design nominal is not available. Measure the light intensity at test points one (1) through 13, record. Calculate the average. Center the 500 mm stray light circle at the target point. Measure the stray light at test points 14 through 21, and record. When recording the tester should calculate the averages of the points one (1) to 13 for focus light, and points 14 through 21 for stray light.

If reusing an existing lamp, the focus light circle can be shifted $\pm$ 100 mm from the center of the stray light circle.

4.3.2 Vanity Lighting. See Appendix A, Figure A2 for targeting details. To begin this test, the 250 mm circle is held parallel to the mirror, at a distance of 300 mm, with the mirror and circle centers aligned along the z-plane. The light intensity shall be measured at five (5) target points and recorded on the data sheet. Lighted vanity mirrors with adjustable intensity levels are to meet the performance requirements called out in GMW14118. Record the measurements.

4.3.3 Ambient Lighting. Ambient lighting is program specific. The target lighting requirements should be called out in Appendix B, if applicable. Test according to the targets in Appendix B, using the requirements from GMW14118. Record the data.

4.3.4 Courtesy Lighting. See Appendix A, Figure A3 for targeting details. Position the 300 mm x 300 mm square template at the center of the seat cushion, with the seat in position from the Reading Lamp measurement location. Measure the light intensity on each seat at five locations on the template, four (4) corners and the center. Record the data and calculate the average-value. This process is repeated for all courtesy lamps.

4.3.5 Footwell Lighting. See Appendix A, Figure A4 for targeting details. To measure footwell lighting position the 400 mm x 400 mm square template for the front row seats and a 250 mm x 400 mm rectangle template for the other rows. Center the template in the target area of the footwell. Measure the light intensity at five locations in each footwell area; the center and each corner. Record and calculate the average. (If the footwell area is smaller than the defined target area, use a "best fit" area for measurement).

4.3.5.1 Footwell Placement of Targeting Template. See Appendix A, Figure A4 for targeting details. Note that due to the variation of Footwell shapes from vehicle to vehicle, if the template placement detailed in this specification does not result in the template being essentially flat on the floor, a deviation to the placement will be required. In this situation, review with the Ambient Lighting team to determine alternate placement.

4.3.5.1.1 Front Footwell. Move front seat to full rear position. First find center between the end of the forward most fixed Front Seat Rail and tangent of upturn to firewall. This is the center of template in X-direction (fore/aft). Next, center template between narrowest width of Footwell along the 400 mm X-length established first. See Appendix A, Figure A5.

4.3.5.1.2 Car/SUV/CUV Rear Footwell. Move front seat to nominal position. First center the template in X-direction (fore/aft) between the end of the rearward most fixed Front Seat Rail and tangent of upturn to Rear Seat. Next, center the template cross car between Front Seat Rails. If this results in plate interfering with Floor

Center Tunnel, shift plate outboard to tangent of upturn to Floor Center Tunnel while maintaining X-direction centerline. See Appendix A, Figure A6.

4.3.5.1.3 Truck Rear Footwell. Move front seat to full rearward position. First, place car forward edge of template 100 mm car rearward of rear most fixed Front Seat Rail. Next, center the template cross car between Front Seat Rails. If this results in plate interfering with Floor Center Tunnel, shift plate outboard to tangent of upturn to Floor Center Tunnel while maintaining X-direction centerline. See Appendix A, Figure A6.

4.3.6 Door Entry/Exit Lighting. See Appendix A, Figure A7 for targeting details. To position the template in the target area, it must be offset 100 mm from the door trim line and offset 100 mm the outboard rocker panel line. The target area is created by the arc created as the door swings from the closed to full open position. Measure the light intensity at the five points of the target area. Points two (2), three (3), and four (4) are located at the corners of the target area. Point five (5) is defined as the midpoint of the arc, between points two (2) and four (4). Point one (1) is defined as the midpoint between points three (3) and five (5). If the vehicle is only available as a coupe, the target area for/aft length between points two (2) and three (3) is 800 mm. Record the data and calculate the average of the five (5) points.

4.3.7 Rear Puddle Lighting. See Appendix A, Figure A8 for targeting details. Position the template at the rear edge of the vehicle bumper, centered in the cargo area opening. Measure the light intensity at five (5) points on the oval shaped template. If the bumper shadows the target area, the template can be moved rearward up to 150 mm to avoid the shadow.

4.3.8 Glove Box/Compartment Bin Lighting. See Appendix A, Figure A9 for targeting details. Measure the light intensity at the center and four (4) "floor" corners of the glove box (stationary bin design) or the center and four corners on the door (rotating bin design). Record the readings and calculate the average Lux; (A unit of illumination or illuminance, 1 lux (lx) = 1 lm/m²), value of the five measurements. If a user manual is to be stored in the bin, adjust measurements to include the manual.

4.3.9 Trunk Lighting. See Appendix A, Figure A10 for targeting details. The trunk area, rectangle one (1), is a rectangular area that "best fits" the trunk floor. The rectangle two (2) target area has the same center point as rectangle one (1), and is offset 150 mm inboard/fore/aft from rectangle one (1). Measure the light intensity at five locations of rectangle two (2), the center and its four corners. Record and calculate the average Lux. If storage compartments are provided in the trunk the intensity at the center of the floor of each compartment shall be a minimum of five Lux.

4.3.10 Cargo Lighting. See Appendix A, Figure A10 for targeting details. The cargo area, rectangle one (1), is a rectangular area that "best fits" the cargo floor. The rectangle two (2) target area has the same center point as rectangle one (1), and is offset 150 mm inboard/fore/aft from rectangle one (1). Measure the light intensity at five locations of rectangle two (2), the center and its four corners. Record and calculate the average Lux. If storage compartments are provided in the cargo area the intensity at the center of the floor of each compartment shall be a minimum of five Lux.

5 Data

5.1 Calculations. All calculations are automatically completed in the Lighting Evaluation Form, see Appendix B.

5.2 Interpretation of Results. Not applicable.

5.3 Test Documentation. Not applicable.

5.4 TALC approval supercedes measurement reports.

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.

Ambient Lighting: Ambient lighting illuminates vehicle interior features at a low level that is not distracting to the driver. The lighting is activated when the headlights are in use.

Entry Lighting: Lighting that comes on when an open or unlock door signal is transmitted into the vehicle. It provides illumination for easy entry/egress and locating objects in the vehicle.

Focus Lighting Circle: A 300 mm circle used to measure lighting performance of reading lamps. The lighting circle has concentric circles drawn in at 135 mm diameter, and 218 mm diameter.

Illuminance: The density of light striking a surface. It is usually measured in Lumens per square foot otherwise known as footcandles (fc) or Lumens per square meter that is referred to as lux. Illuminance criteria are usually given as a minimum illuminance on the task areas, even after the light level has depreciated over time. The orientation of the surface may be defined, e.g., horizontal, vertical, hence the terms horizontal illuminance, vertical illuminance.

Lux: A unit of illumination or illuminance. 1 lux (lx) = 1 lm/m²

Stray Lighting Circle: A 500 mm circle used to measure stray light for reading lamps.

Task Lighting: Lighting for a specific purpose, turned on with a switch or by opening a cover compartment.

7.2 Acronyms, Abbreviations, and Symbols.

EWO	Engineering Work Order
fc	Footcandles
GDM	Global Document Management
SgRP	Seating Group Reference Point

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Test to GMW14271

9 Release and Revisions

This standard was originated in August 2005. It was first approved by Interiors in February 2006. It was first published in May 2007.

Issue	Publication Date	Description (Organization)
1	MAY 2007	Initial publication.
2	OCT 2014	5 Year Refresh. (Interior – Interior Lighting)
3	SEP 2019	Updated: 3.2.1.; 3.6; 4.3.4; Added 4.3.5.1 & 5.4; added Figures A4, A5 and A6. (Interior - Global Instrument, Floor Console, Door, Decorative and Ambient Lighting)

Appendix A

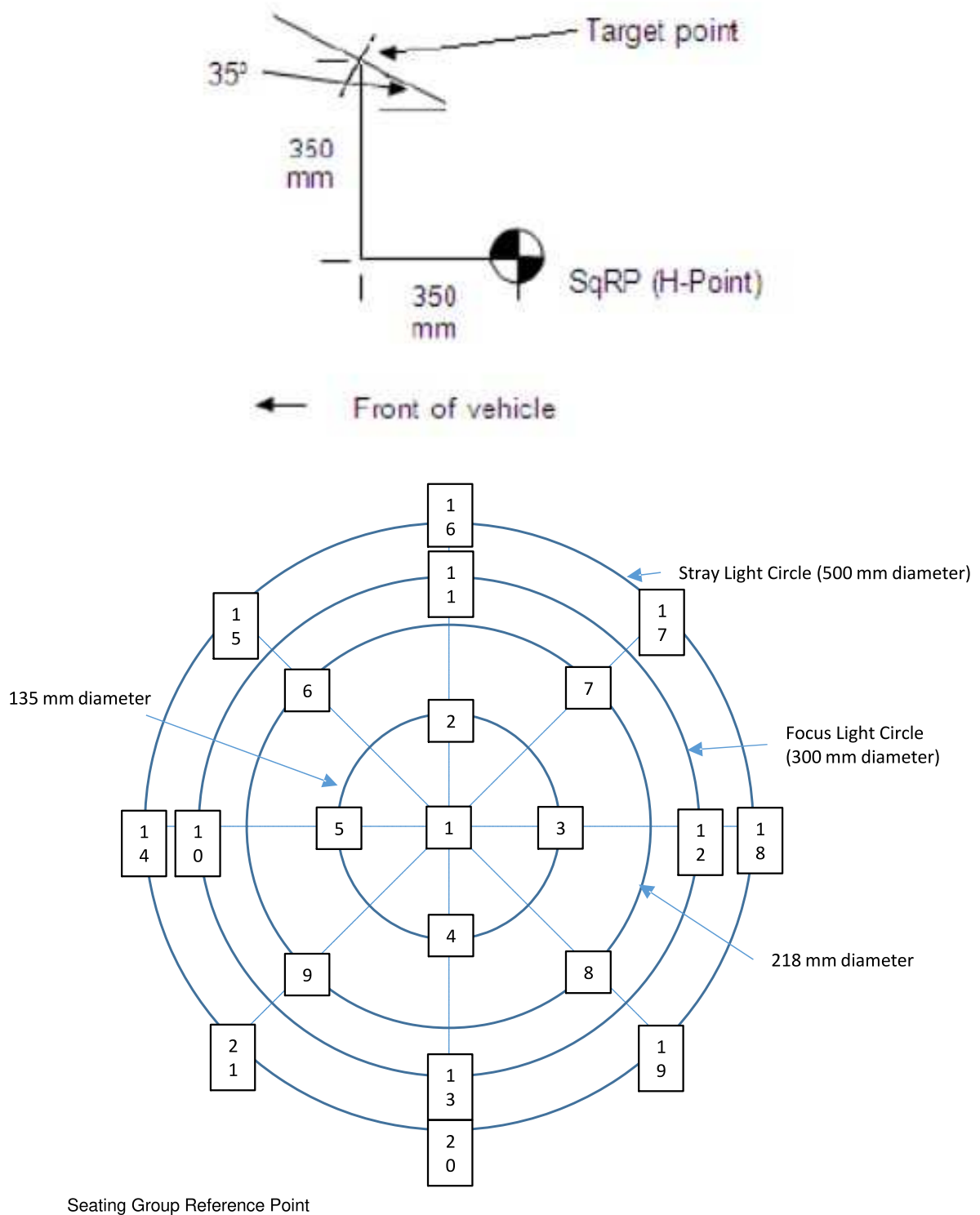


Figure A1: Reading Lamp Target Area