



Interior Lighting Subsystem Technical Specification

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 the Interior Lighting Subsystem is to meet the demands for internal illumination which are generated through vehicle use and the voice of the customer. The Interior Lighting Subsystem will deliver internal illumination functions while meeting interface, performance, regulations, standards, and corporate objectives.

1.2 Applicability. This specification applies to and defines the requirements for all Interior Lighting Subsystems used in General Motors vehicles worldwide. These specifications are in addition to the specifications contained within the Statement of Requirements (SOR) documents. Any exceptions to specifications contained within this document must be stated in the program specific CG2175 SOR Appendix C2 (or Z) document, Exceptions to the Interior Lighting Subsystem Technical Specification (SSTS).

1.3 Remarks. The requirements contained within this document for the Interior Lighting Subsystem include: physical, functional, performance, appearance, design constraints, reliability, and validation.

Some sections are broad in scope, as this document must cover many different types of Interior Lighting Subsystems which vary in content, function, location, and design in order to satisfy the specific needs of a vehicle program. The Interior Lighting Subsystem shall also comply with the program specific Vehicle Technical Specification (VTS).

2 References

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

2.1 External Standards/Specifications.

AEC Q101	FMVSS 101	ISO 1629	SAE/USCAR-15
CMVSS 201	FMVSS 201	ISO 11469	SAE/USCAR-21
CMVSS 302	FMVSS 302	JESD22-A114-B	SAE/USCAR-25
CNCA-C11-01	GB 8410	SAE J941	SAE/USCAR-33
CNCA-C11-09	GSO 98	SAE J1889	SAE/USCAR-38
ECE R21	ISO 1043-1	SAE J2602-2	TRIAS 48
ECE R37	ISO 1043-2	SAE/USCAR-3	TS-INT-001

2.2 GM Standards/Specifications.

GMW3059	GMW3431	GMW14234	GMW15246
GMW3091	GMW3600	GMW14271	GMW15272
GMW3097	GMW7294	GMW14298	GMW15987
GMW3103	GMW7699	GMW14334	GMW16331
GMW3116	GMW8518	GMW14444	GMW16449
GMW3172	GMW14011	GMW14573	GMW16853
GMW3191	GMW14089	GMW15118	GMW17000
GMW3232	GMW14188	GMW15199	

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2.3 Additional References.

- CG1054 SOR Appendix H
- CG1663 SOR Appendix C3
- CG1777 Solderless Crimp
- CG2175 SOR Appendix C2 (or Z)
- CG2492 SOR Appendix B (or X)
- CG3535 SOR Appendix G2
- CG3796 Connector and Terminal Design Requirements
- CG3913 SOR Appendix B2
- Current Product Engineering (CPE) report PG54142, "Los Angeles Area Ozone Data, and its Application to Laboratory Ozone Testing"
- Dimensional Technical Specification (DTS)
- European Union End-of-Life Vehicle Directive Heavy Metal Ban
- Global Customer Audit
- Global Regulations
- GM Approved Bulb List
- GM Best Practices (The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement)
- GM Europe International Technical Development Center (ITDC) Environmental Strategy and Regulations
- GM Global Legal Database
- GM Recommended Connector Catalog
- Owner's Manual
- Power and Signal Distribution Subsystem Technical Specification for Global Vehicle Platforms
- Recycled Materials File
- Requirements of Certification Accreditation Administration of the People's Republic of China
- Vehicle Technical Specification (VTS)

3 Requirements

Note: The Interior Lighting Subsystem shall be lead free and compliant to the European Union End-of-Life Vehicle Directive Heavy Metal Ban.

Note: In addition to the requirements defined in this specification, the Interior Lighting Subsystem shall comply with all applicable GM Best Practices (The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement).

3.1 System/Subsystem/Component/Part Definition. The Interior Lighting Subsystem provides illumination for vehicle occupants inside the passenger compartment. The Interior Lighting Subsystem consists of, but is not limited to the following task lamps: overhead reading and/or courtesy, vanity mirror, glove box, footwell, door entry/exit, floor console compartment, trunk, and cargo. It also includes ambient lighting such as pin spots and light guides.

3.1.1 Appearance. All GM Interior Lighting Subsystems shall be designed to comply with the appearance specifications described in 3.1.1.1 thru 3.1.1.8.

Note: When evaluating from the seated position, use SAE J941 99th percentile eyellipse for each occupant position.

3.1.1.1 The Interior Lighting subsystem components shall be free of part imperfections, manufacturing marks, visible parting lines, and unfinished edges on the A-surface. None of these items shall be visible with the doors open from outside the vehicle, from any seated position in the vehicle, or while operating the Interior Lighting Subsystem.

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3.1.1.2 Only A-surface and secondary styled surfaces shall be visible to the seated occupants. The following are examples of what shall not be visible to the seated occupants: light sources, retainers, fasteners, connectors, wiring, and B-surface ribs on lenses, etc.

3.1.1.3 All circuit boards that are visible when the lamp is viewed from any angle shall be of a color that minimizes the circuit board's appearance. The color of any printing on the board shall also be chosen to minimize appearance.

3.1.1.4 Part breakup shall be established such that the resulting gaps are hidden or minimized to the occupant's line of sight.

3.1.1.5 Tolerances for gap, parallelism, and flushness shall be defined in the program specific Dimensional Technical Specification (DTS).

3.1.1.6 The Interior Lighting Subsystem shall be designed to prevent any light leaks within the assembly and packaged to prevent any light bleed into surrounding areas.

3.1.1.7 Refer to CG2492 SOR Appendix B (or X) and CG3913 SOR Appendix B2, the Graphic Lighting Appearance Document (GLAD) for program specific appearance specifications.

3.1.1.8 The Interior Lighting Subsystem shall comply with the Touch, Appearance, Lighting, Color (TALC) specifications described in GMW14298, GMW15118, and GMW15199.

3.1.2 Content. The Interior Lighting Subsystem, as a standalone assembly and as an integrated assembly to the vehicle, shall be designed to the physical and functional specifications contained and referenced within this document.

3.1.2.1 Physical Content. The Interior Lighting Subsystem is typically an assembly that contains a light source, lens, housing, and connector. In some cases, a reflector, light shield, circuit board, and/or light guide may also be included to meet the performance requirements and desired appearance.

3.1.2.2 Functional Content. The Interior Lighting Subsystem provides illumination for the driver/occupants inside the passenger compartment of the vehicle. This lighting can be task/functional, providing light for reading, illuminating storage bins, etc. Or it can be ambient lighting that provides a lower intensity glow for the passenger compartment used for both styling/appearance and to provide some function at night.

3.1.3 Ambient Environment. The Interior Lighting Subsystem shall meet the performance and durability requirements defined in this specification. The Interior Lighting Subsystem shall operate without physical damage or functional degradation when exposed to the ambient and operating environmental conditions defined in 3.1.3.1 thru 3.1.3.8 unless otherwise noted.

3.1.3.1 Temperature. During the life of the vehicle the Interior Lighting Subsystem may experience "in the vehicle" ambient temperatures of -40 °C to 85 °C.

3.1.3.1.1 The Interior Lighting Subsystem shall function and meet all requirements of this specification with "in the vehicle" ambient temperatures of -20 °C to 65 °C.

3.1.3.1.2 The Interior Lighting Subsystem shall operate but may not meet the illuminance requirements of this specification at the temperature extremes.

3.1.3.2 Ambient Room Temperature. For testing purposes, ambient room temperature is defined as 23 °C ± 5 °C.

3.1.3.3 Voltage and Current. The Interior Lighting Subsystem shall function within a vehicle system voltage range of 9.0 Vdc to 16.0 Vdc unless specified differently in CG2175 SOR Appendix C2 (or Z). The ambient lights, control backlighting and switch activation indicator circuits are provided vehicle system voltage that is Pulse Width Modulation (PWM) at a frequency of 100 Hz ± 5% that allows for customer adjusted dimming. The courtesy lamp circuit is provided the same system voltage and is PWM controlled during periods of "Theater Dimming" and "Theater Brightening" at the same 100 Hz frequency. Customer switched lights such as Map/Reading and Glove Box are provided vehicle system voltage that is not PWM controlled but is protected for battery run down if the lamp is left activated when the vehicle power is OFF.

3.1.3.4 Humidity.

3.1.3.4.1 All electrical/electronic Interior Lighting Subsystem components shall meet the specifications defined in the Humidity Test section in GMW3172.

3.1.3.4.2 All nonelectrical/nonelectronic components of the Interior Lighting Subsystem shall meet the performance requirements when:

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3.1.3.4.2.1 Operated in a condensing atmosphere to maximum temperature of 45 °C with a 95 % ± 5% relative humidity.

3.1.3.4.2.2 Stored in a condensing atmosphere to maximum temperature of 65 °C with a 95 % ± 5% relative humidity and subsequently operated per the performance specifications contained in this document.

3.1.3.5 Electrical/Electronic Environmental Codes. The requirements of GMW3172 apply to Interior Lighting Subsystems with electronic components (e.g., control units, Light Emitting Diodes (LED) lamps, etc.) These requirements apply to the Interior Lighting Subsystem in addition to the ambient environment specifications listed in the preceding. The classification code is defined in CG2175 SOR Appendix C2 (or Z), Exceptions to the Interior Lighting SSTS.

3.1.3.6 Thermal Shock. The Interior Lighting Subsystem, excluding incandescent bulbs and switches, shall comply with GMW3172 Thermal Shock in Air, Operating Type 1.2. The Interior Lighting Subsystem shall function between 9 V and 16 V during and after the part being subjected to thermal shock between temperature extremes of -20 °C to 65 °C. Maximum transition time between exposures to extremes is one (1) minute. Minimum dwell time at maximum and minimum temperatures is 60 minutes.

Note: Bulb failure during thermal shock testing is acceptable if replacement of the bulb results in a functional component.

3.1.3.7 Ozone. If molded and extruded soft and sponge rubber material is being used, the expected ozone operating environment is a maximum (instantaneous value) ozone concentration of 0.40 ppm with an average of 0.029 ppm for ten (10) years of exposure. Such ozone exposure shall not affect the Interior Lighting Subsystem performance. Refer to the Current Product Engineering (CPE) report PG54142, "Los Angeles Area Ozone Data, and its Application to Laboratory Ozone Testing".

3.1.3.8 Storage. The Interior Lighting Subsystem shall function and meet all the requirements of this specification after exposure to the storage/shipping test cycle shown in Table 1. Function shall be checked at ambient temperature after each exposure cycle.

Table 1: Storage/Shipping Test Cycle

Cycle	Temperature	Duration
1	85 °C	One (1) week
	Ambient (23 °C ± 5 °C)	≥ 15 minutes
2	-40 °C	One (1) week
	Ambient (23 °C ± 5 °C)	≥ 15 minutes
Note: Lamps shall be unlit during test cycles.		

3.1.4 Interfaces. The electrical and physical interface requirements are defined here in 3.1.4 and apply over the voltage and temperature range of the Interior Lighting Subsystem defined in 3.1.3.

3.1.4.1 Subsystem to Subsystem. This 3.1.4.1 section identifies physical interfaces between the Interior Lighting Subsystem and other Vehicle Subsystems. The subsystem is to meet all requirements specified in this document without damage or defect being created through the specified interface.

3.1.4.1.1 Power and Signal Distribution Subsystem Interface. The Power and Signal Distribution Subsystem shall be the source of electrical power for the Interior Lighting Subsystem. It is recognized that electrical power originates from the Charging and Energy Storage Subsystem. The distinction regarding source, that is made here, permits the Interior Lighting Subsystem to concentrate on delivered power needs while considerations for line losses, shared circuitry, etc., are left to the Power and Signal Distribution Subsystem. The Interior Lighting Subsystem shall interface with the vehicle's Power and Signal Distribution Subsystem as described in 3.1.4.1.1.1 thru 3.1.4.1.1.3.

3.1.4.1.1.1 The Interior Lighting Subsystem shall accept electrically transmitted control signals and data originated by other subsystems via the Power and Signal Distribution Subsystem.

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3.1.4.1.1.2 The Power and Signal Distribution Subsystem shall be used for electrical transmission to components of the Interior Lighting Subsystem.

3.1.4.1.1.3 The interface between the Power and Signal Distribution Subsystem and Interior Lighting Subsystem shall be documented in an Interface Control Document-electrical (ICDe) and approved by the Electrical Design Release Engineer (DRE).

3.1.4.1.2 Interior Trim Subsystem Interface. An Interior Trim Subsystem is defined as one of the following: instrument panel, console, seat, garnish trim, door trim, roof trim, floor trim, and rear compartment trim. Specified Interior Lighting Subsystem components are to be packaged on or in select Interior Trim Subsystems. Both subsystems shall be designed to meet the requirements in 3.1.4.1.2.1 thru 3.1.4.1.2.2.

3.1.4.1.2.1 The Interior Trim Subsystem shall provide mounting surfaces and possibly a housing/bezel for certain Interior Lighting Subsystem components.

3.1.4.1.2.2 The Interior Lighting Subsystem shall provide dimensional and location criteria to the Interior Trim Subsystem.

3.1.4.1.3 Body Structure Subsystem Interface. The Interior Lighting Subsystem shall interface with the vehicle's Body Structure Subsystem per 3.1.4.1.3.1 thru 3.1.4.1.3.3.

3.1.4.1.3.1 The Body Structure Subsystem shall provide mounting surfaces for certain Interior Lighting Subsystem components.

3.1.4.1.3.2 The Interior Lighting Subsystem shall provide dimensional and location criteria to the Body Structure Subsystem.

3.1.4.1.3.3 The interface requirements should be documented in an Interface Control Document-mechanical (ICDm).

3.1.5 Usage Definition. Not applicable.

3.2 Product Characteristics. Product characteristics describe the Interior Lighting Subsystem in terms of performance, physical characteristics, dependability, serviceability, and user subsystem interface requirements. The subsystem is to satisfy all of the requirements described under the operating conditions stated in 3.1 and any additional conditions specified herein.

3.2.1 Performance Requirements. The Interior Lighting Subsystem is to provide equipment to meet the vehicle's functional interior lighting demands generated during the use of the vehicle over a wide range of expected conditions. Functional performance requirements are specified and shall be evaluated to procedure and requirement references included per this 3.2.1 section. In the event of conflicting requirements, the requirements in this document shall take precedence; with the exception to Global Regulations and the VTS.

3.2.1.1 Interior Lighting Subsystem Performance.

3.2.1.1.1 General Design Requirements. The Interior Lighting Subsystem must be designed to meet the requirements in 3.2.1.1.1.1 thru 3.2.1.1.1.8. Refer to CG2492 SOR Appendix B (or X) for any additional program specific performance requirements.

3.2.1.1.1.1 State, Federal, and Country Regulations.

3.2.1.1.1.1.1 The Interior Lighting Subsystem shall be designed to meet all State and Federal Regulations.

3.2.1.1.1.1.1.1 Flammability. The Interior Lighting Subsystem and components, shall satisfy the burn resistance requirements of FMVSS 302, CMVSS 302 (Canada - where applicable), GSO 98 (Gulf State Countries - where applicable) TRIAS 48 (Japan - where applicable), and GB 8410 (China - where applicable) according to GMW3232.

3.2.1.1.1.1.1.2 Interior Fittings. The Interior Lighting subsystem and components shall contribute in meeting export ECE R21 at a vehicle level, CMVSS 201 and FMVSS 201 requirements for all countries that a vehicle is being exported to per program. Parts will be evaluated for exposed radii and hardness according to ECE R21.

3.2.1.1.1.1.1.3 Controls and Displays. The ambient Interior Lighting Subsystem shall comply with FMVSS 101. It is required that the ambient light sources be dimmable and turn "OFF" at the lowest setting of the dimming curve. Adequate intensity and area of illumination will be assessed and approved at the scheduled TALC reviews.

3.2.1.1.1.1.1.4 Bulbs. For Economic Commission for Europe (ECE) applications, only approved light sources listed in ECE R37 and the applicable lamp regulation shall be used.

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3.2.1.1.1.1.5 Interior Emissions. The Interior Lighting Subsystems and Interior Lighting Subsystem Components shall meet all interior emissions requirements per GMW14444. Additionally, for vehicles sold in China, TS-INT-001 testing is required. Additional details are documented in GMW16853.

3.2.1.1.1.1.6 China Compulsory Compliance. The Interior Lighting Subsystem and components shall comply with the Requirements of Certification Accreditation Administration of the People's Republic of China for all parts that will be exported to or sold in the China market. The supplier is responsible for the China Compulsory Certification mark and report. The China Compulsory Certification report shall be submitted on time. Requirements for China Compulsory Certification are CNCA-C11-01 and CNCA-C11-09.

3.2.1.1.1.1.7 Other Regulatory Requirements. The Interior Lighting Subsystem and components shall comply with requirements for export to the countries of sale listed in CG2175 SOR Appendix C2 (or Z). Specific country regulatory requirements can be found in the GM Global Legal Database. Contact the appropriate regulatory engineer for details.

3.2.1.1.1.2 Design to Prevent Light Leaks. The Interior Lighting Subsystems and Interior Lighting Subsystem Components shall be designed to interface with other Interior Subsystems to prevent light leaks visible within the vehicles interior and visible while standing outside the vehicle with doors and/or trunk/cargo lids open.

3.2.1.1.1.3 Lens Retention. The lens of a lamp assembly shall be designed to withstand a load of 45 N applied normally to the center of the lens without loss of retention from any of the interfacing components and adjacent subsystems. If the lens surface is also used to actuate the Interior Lighting Subsystem, the lens shall be designed to withstand a load of 110 N applied normally to the center of the lens without loss of retention from the interfacing components and adjacent subsystems.

3.2.1.1.1.4 Bulb Retention. Bulbs shall withstand a load of 10 N without loss of retention. Bulb shall not dislodge from vibration inputs incurred during Squeak and Rattle validation testing. The bulb to bulb socket interface shall comply with SAE/USCAR-15, Specification for Testing Automotive Miniature Bulb Socket/Circuit Plate assemblies.

3.2.1.1.1.5 Light Guide Retention. Light guides/pipes shall withstand a load defined in CG2175 SOR Appendix C2 (or Z), exceptions to the Interior Lighting SSTS, without loss of retention. The guide shall not dislodge from its retainer/attachment to trim from vibration inputs during Buzz, Squeak and Rattle (BSR) testing or throughout dimensional stability testing.

3.2.1.1.1.6 Lamp Retention. Refer to Table 2 for the required tensile load that the complete lamp assembly shall be designed to withstand, applied normally to the lamp housing. Vertically mounted lamp assemblies in trim are listed as "Dynamic" due to slam test requirements for some subsystems (i.e., door trim, liftgate trim, etc.)

Table 2: Lamp Retention to Trim Requirements

Roof Trim Mounted	Trim Mounted (Static)		Vertically Mounted to Trim (Dynamic)
100 N	Soft Trim	Hard Trim	70 N
	20 N	45 N	

3.2.1.1.1.7 Switch Requirements.

3.2.1.1.1.7.1 Switches shall meet requirements specified in CG1663 SOR Appendix C3 and GMW15987.

3.2.1.1.1.7.2 Component Deflection.

3.2.1.1.1.7.2.1 If an Interior Lighting Subsystem contains switches or buttons, operation shall be achieved without perceived deflection of the Interior Lighting Subsystem or adjacent interior trim.

3.2.1.1.1.7.2.2 If an Interior Lighting Subsystem contains switches or buttons, the component must meet a maximum allowable deflection of 2.5 mm with a 50 N force and 5.5 mm with a 100 N force.

3.2.1.1.1.8 Bulb and Light Source Requirements.

3.2.1.1.1.8.1 All bulbs shall comply with SAE/USCAR-3.

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3.2.1.1.1.8.2 Bulbs shall be chosen from the GM Approved Bulb List. Refer to CG2175 SOR Appendix C2 (or Z) for the list.

3.2.1.1.1.8.3 The bulb shall be specified to a GM part number and referenced to a trade number.

3.2.1.1.1.8.4 For ECE applications, only approved light sources listed in ECE R37 and the applicable lamp regulation shall be used.

3.2.1.1.1.8.5 All LEDs shall comply with SAE/USCAR-33.

3.2.1.1.1.8.6 LEDs shall conform to Automotive Electronics Council (AEC) - AEC Q101. The Electrostatic Discharge (ESD) rating of LEDs (without any external ESD protection circuit) shall be 2000 V or higher per JESD22-A114-B or equivalent standard.

3.2.1.1.1.8.7 All LEDs for all lighting functions shall be binned such that intensity and color differences cannot be discerned when installed on the vehicle as judged during a dark room evaluation demonstration of the extreme range of input voltages and LED binning combinations (both color and intensity and forward voltage).

3.2.1.1.1.8.8 LED bin colors shall match between like functions (left to right, within an assembly, and within the same type of system (i.e., ambient lighting system)).

3.2.1.1.1.8.9 Any LED module and electronic component used in the Interior Lighting Subsystem shall have a parasitic current value of zero (0) in the off state.

3.2.1.1.1.8.10 The LED circuit must be designed to meet ESD requirements and prevent glow. Reference Figure 1 for recommended circuit diagram.

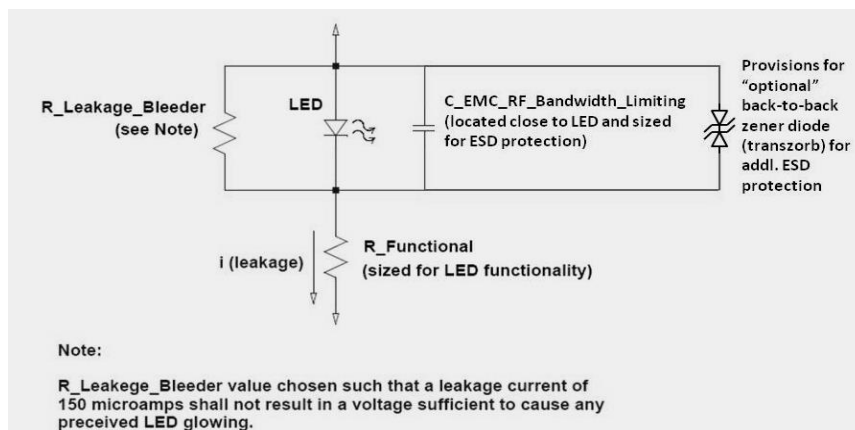


Figure 1: LED Circuit Diagram

Note: Continuous_Electromagnetic Compatibility_Radio Frequency = C_EMC_RF, Additional = addl.

3.2.1.1.1.8.11 The Color Rendering Index (CRI) for white LEDs shall be at or above 73 at 2700 °K.

3.2.1.1.2 Interior Illumination Performance. The Interior Lighting Subsystems shall be designed to fulfill the requirements in 3.2.1.1.2.1 thru 3.2.1.1.2.4 as tested per GMW14271.

3.2.1.1.2.1 Courtesy Lighting Requirements. Courtesy lighting provides general illumination in and around the passenger compartment. It is typically activated when the vehicle receives an unlock signal, a door is opened, or the dome override switch is activated. It is meant to assist occupants with entry/egress and locating objects inside the vehicle. Courtesy lighting requirements for illuminance and uniformity within the target area are specified in Table 3 for each type of lamp.

3.2.1.1.2.1.1 Voltage. Illuminance requirements for courtesy lamps are defined at a voltage level of $12.5\text{ V} \pm 0.1\text{ V}$.

3.2.1.1.2.1.2 Sill Plate Lighting. Illuminated sill plates are used to show brand identification during customer entry/egress. If the lit sill plates are packaged within the interior, the measurements should be taken on the surface of the backlit design. The luminance values and target area shall be defined in CG2175 SOR Appendix C2 (or Z); Exceptions to the Interior Lighting SSTS.

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Table 3: Courtesy Lighting Performance Requirements

Location/Function	Illuminance	Uniformity	Target Area
Overhead Courtesy Lighting Package to flood the seat cushion areas and illuminate the passenger compartment.	Average of five (5) points $\geq 10 \text{ lx}$ (7 lx minimum at each point)	$\leq 2:1$ maximum/minimum ratio	Measure the illuminance of the courtesy lamp on each seat cushion (for every occupant) at five (5) locations: the center and the four (4) corners of a 300 mm x 300 mm square centered on the seat cushion (see Figure B1).
Footwell Lighting Package the lamp to be focused on the center of the footwell area.	Average of five (5) points $\geq 5 \text{ lx}$	$\leq 3:1$ maximum/minimum ratio	For front row seats, measure the illuminance of each footwell lamp at five (5) locations: the center and the four (4) corners of a 400 mm x 400 mm square centered in the footwell (see Figure B2). For all other rows, measure the illuminance of each footwell lamp at five (5) locations: the center and the four (4) corners of a 250 mm (fore/aft) x 400 mm rectangle (see Figure B2). Note: If the footwell area is smaller than the target area, then the maximum length and width of the footwell area shall be used as the target area.
Door Entry/Exit (Puddle) Lighting The door entry/exit lamp shall be focused on the ground between the door, in its maximum open position, and the vehicle's body at the door opening. Note: If vehicle is available in both a coupe and a sedan, package for sedan door.	Average of five (5) points $\geq 5 \text{ lx}$ Note: Do not include any points that are shadowed by vehicle in measurements.	$\leq 5:1$ maximum/minimum ratio	Measure the illuminance of the door entry/exit lamp at each door opening at five (5) locations: the center, three (3) corners, and center of arc length of the target area (see Figure B3). The five (5) measurement locations are defined as: points two (2), three (3), and four (4) are located at the corners of the target area; point five (5) is located at the midpoint of the arc length between points two (2) and four (4); point one (1) is located at the midpoint between points three (3) and five (5). Note: The target area is defined as the arc area created when the door trim line is offset 100 mm with the door in the full open position, the outboard rocker panel line is offset 100 mm, and the arc created as the door swings from the closed to the full open position (see Figure B3).

3.2.1.1.2.2 Task/Functional Lighting Requirements. Task (or functional) lighting provides focused illumination to a specific area of the passenger compartment to assist occupants in completing a task. It includes reading lamps and illumination to storage compartments. Interior Lighting Subsystems grouped within this category can have occupant actuated switches or indirect switches actuated by opening a compartment. Task/functional lighting requirements for illuminance and uniformity within the target area are specified in Table 4 for each type of lamp.

3.2.1.1.2.2.1. Voltage. Illuminance requirements for task/functional lamps are defined at a voltage level of $12.5 \text{ V} \pm 0.1 \text{ V}$.

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3.2.1.1.2.2.2 Reading Lamps that also function as courtesy lamps. If a reading lamp is to also function to provide courtesy illumination and the vehicle does not have a dedicated courtesy lamp, the reading lamps shall be designed to meet the reading lamp performance specifications and shall have a courtesy lamp average illuminance of 8 lx.

If it is not possible to meet all requirements due to design constraints, the priority of requirements should be:

- Focused Light
- Stray Light
- Uniformity

3.2.1.1.2.2.3 Re-use of Existing Reading Lamps. If the reading lamp to be used is carryover from another vehicle program, the 300 mm focus light circle can be located ± 100 mm from the center of target for LED or ± 250 mm for incandescent (see Figure B5).

Table 4: Task/Functional Lighting Performance Requirements

Location	Illuminance	Uniformity	Target Area
Reading Lamps Package reading lamps to provide focused light to the defined target area for the occupant to read maps, etc. Must be within reach for switch activation.	<u>Focus:</u> Between 55 lx to 75 lx Average of points 1 to 13 <u>Stray:</u> ≤ 25 lx Average of points 14 to 21	$\leq 3:1$ maximum/minimum ratio	Center the circular targets 350 mm forward and 350 mm above the Seating Reference Point (SgRP) or Hip-Point (H-Point) reference. <u>Focus Target:</u> 300 mm circle (Points 1 to 13) <u>Stray Target:</u> 500 mm circle (Points 14 to 21) Both oriented at a 35 degree angle from horizontal (see Figure B4)
Vanity Mirror Lamps Package to provide soft illumination in direction of occupant's face when looking in mirror.	<u>Fixed Intensity:</u> Between 15 lx to 35 lx Average of five (5) points <u>Adjustable Intensity:</u> 15 lx shall fall within the adjustable intensity range Note: Illuminance at each point shall be between 10 lx and 40 lx	$\leq 2:1$ maximum/minimum ratio	250 mm circular target oriented parallel to a vertically positioned mirror at a perpendicular distance of 300 mm from the mirror. Align the center of the target with the center of the mirror (see Figure B5).
Storage Compartment Lamps Package to maximize the spread of light within the compartment.	≥ 25 lx Average of five (5) points (5 lx minimum at each point)	$\leq 4:1$ maximum/minimum ratio	Floor of the storage compartment/bin. Measure at center and four (4) corners on the bin's floor (see Figure B6).

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Location	Illuminance	Uniformity	Target Area
Trunk Lamp Package lamp to provide illumination to the entire trunk area. Preferred location is the underside of the rear window trim ± 150 mm cross car and ± 250 mm (fore/aft) of the center of the trunk.	≥ 20 lx Average of five (5) points (10 lx minimum at each point) If there are storage compartments in trunk, the center of the compartment floor shall be 5 lx minimum.	$\leq 4:1$ maximum/minimum ratio	Define a rectangle (one (1)) to fit the maximum size of the trunk load floor. Create a second rectangle (two (2)) inboard 150 mm from rectangle one (1), sharing the same center point. Measure at center and four (4) corners of rectangle two (2) (see Figure B7).
Cargo Area Package the lamp(s) to illuminate the entire rear cargo area.	≥ 10 lx Average of five (5) points (5 lx minimum at each point)	$\leq 4:1$ maximum/minimum ratio	Define a rectangle (one (1)) to fit the maximum size of the cargo load floor. Create a second rectangle (two (2)) inboard 150 mm from rectangle one (1), sharing the same center point. Measure at center and four (4) corners of rectangle two (2) (see Figure B7).
Rear Puddle Lamp Package the lamp to illuminate the ground rearward of vehicle.	≥ 2 lx Average of five (5) points (1 lx minimum at each point)	$\leq 10:1$ maximum/minimum ratio	On ground, rear edge of bumper, using an oval target area with a center (fore/aft) length of 400 mm and a width equal to the interior cargo rear opening (see Figure B8).

3.2.1.1.2.3 Ambient Lighting Requirements. Ambient lighting illuminates vehicle interior features at a low intensity level that is not distracting to the driver. The ambient lighting illuminance and uniformity requirements are summarized in Table 5. Refer to CG2492 SOR Appendix B (or X) and CG2175 SOR Appendix C2 (or Z) for additions or exceptions to the requirements.

3.2.1.1.2.3.1 Compliance.

3.2.1.1.2.3.1.1 The ambient Interior Lighting Subsystem shall comply with FMVSS 101.

3.2.1.1.2.3.1.2 It is required that the ambient light sources be dimmable and turn "OFF" at the lowest setting of the dimming curve.

3.2.1.1.2.3.1.3 Adequate intensity and area of illumination will be assessed and approved at the scheduled TALC reviews.

3.2.1.1.2.3.2 Voltage. Illuminance measurements are to be taken at $13.5\text{ V} \pm 0.1\text{ V}$ at the full brightness level.

3.2.1.1.2.3.3 Light from the ambient source should be contained within the target area with minimal stray light outside of the target area.

3.2.1.1.2.3.4 Differences in illumination between the front, rear, left hand side, and right hand side ambient Interior Lighting Subsystems shall not be discernable.

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