SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

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Determination of the Effective Projected Luminous Lens Area (EPLLA) by Design Analysis

RATIONALE

SAE standards and FMVSS 108 requires a minimum effective projected luminous lens area (EPLLA) for many signal lighting functions. In the past, the determination of the EPLLA was straightforward since most lamps utilized a reflector, a bulb, and a colored cover lens with optics. Newer lighting technologies such as LEDs, reflector type optics with no optics in the cover lens, light pipes, multicolor LEDs, etc. have complicated the determination of EPLLA. This standard was created to clarify the criteria for determining EPLLA through Design Analysis using newer technologies as well as traditional technologies. During the development of this standard, many current and future lamp designs and technologies were considered to ensure that the standard adequately addressed how EPLLA should be determined. This standard contains the industry consensus for these criteria.

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1. SCOPE

This SAE Standard provides a method for determining the Effective Projected Luminous Lens Area (EPLLA) of a lamp function using design analysis. This standard was created to clarify and address how to determine EPLLA with traditional and new technologies. Lamps can be evaluated using the method described in SAE J3333; however, no lamp is subjected to both methods.

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2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J387 Terminology - Motor Vehicle Lighting

SAE J586 Stop Lamps for Use on Motor Vehicles Less than 2032 mm in Overall Width

SAE J588 Turn Signal Lamps for Use on Motor Vehicles Less than 2032 mm in Overall Width

SAE J1432 Rear High Mounted Stop Lamps and Rear High Mounted Turn Signal Lamps for Use on Vehicles 2032 mm or More in Overall Width

SAE J1957 Center High Mounted Stop Lamp Standard for Vehicles Less than 2032 mm Overall Width

SAE J2039 Side Turn Signal Lamps for Large Vehicles

SAE J2087 Daytime Running Light

SAE J2261 Stop Lamps and Front- and Rear-Turn Signal Lamps for Use on Motor Vehicles 2032 mm or More in Overall Width

2.1.2 Federal Publications

Available from the Superintendent of Documents, U. S. Government Printing Office, Mail Stop: SSOP, Washington, DC 20402-9320 or at www.nhtsa.dot.gov.

Federal Motor Vehicle Safety Standard 49CFR 571.108

Available from Transport Canada, Roads Safety and Motor Vehicle Regulation, Ottawa, Ontario K1A 0N5, Canada, www.tc.gc.ca:

Canada Motor Vehicle Safety Act and Regulations - Section 108 (CMVSS 108)

Technical Standard Document No. 108

3. DEFINITIONS

3.1 EFFECTIVE LIGHT-EMITTING SURFACE

That portion of a lamp that directs light to the photometric test pattern, and does not include transparent lenses, mounting hole bosses, reflex reflector area, beads or rims that may glow or produce small areas of increased intensity as a result of uncontrolled light from an area of 1/2 degree radius around a test point.

3.2 EFFECTIVE PROJECTED LUMINOUS LENS AREA (EPLLA)

The area of the orthogonal projection of the effective light-emitting surface of a lamp on a plane perpendicular to a defined Test Pattern direction relative to the axis of reference. Unless otherwise specified, the direction is coincident with the axis of reference.

3.3 TEST PATTERN

The rectangle formed by horizontal and vertical planes passing through the bounding horizontal and vertical photometric test points.

3.4 LIGHT SOURCE ELEMENT

Any portion of a light source (including its optical envelope) that generates light.

3.5 REFLECTIVE ELEMENT

Any surface designed to specularly reflect incoming light from a light source element, reflective element, or refractive element towards the lamp function's test pattern. The surface shall be molded, coated, or similar construction from materials which are typical for reflecting light.

3.6 REFRACTIVE ELEMENT

Any lens with optical structure designed to specularly refract incoming light from a light source element, reflective element, or refractive element towards the lamp function's test pattern.

3.7 DIFFUSION ELEMENT

Any surface or material with light scattering features which randomly reflects or refracts light from a light source element, reflective element, or refractive element.

4. DESIGN ANALYSIS PROCEDURE

4.1 Lamp Function Representation

A scalable drawing or Computer Aided Design (CAD) data or similar scalable representation of the lamp function is required.

The representation shall show the orthogonal projection of the applicable light source elements, reflective elements, refractive elements, and diffusion elements projected onto a plane perpendicular to the applicable axis along with any features which can obstruct the visibility of those elements.

4.2 Element Identification

4.2.1 Light Source Elements

4.2.1.1 Identify all light source elements applicable for the lamp function. Light source element examples include: LED die and phosphor conversion material and optical dome, any optical element in an LED package, a bulb filament or arc and glass envelop, the exit port of a light guide, etc.

4.2.2 Reflective or Refractive Elements

4.2.2.1 Identify all reflective or refractive elements applicable for the lamp function. Only reflective or refractive elements which contribute to a lamp function's optical performance as a result of a light ray's primary intended trajectory shall be included. Reflective or refractive elements which only receive light from rays split off from their primary intended trajectory are not included.

4.2.2.2 The entirety of each reflective or refractive element along with any transition features between reflective or refractive elements required for manufacturing are included. For example, material between reflector facets to allow molding of the facets and any radii required for proper reflector coating.

4.2.2.3 Reflective or refractive elements which direct light towards another reflective or refractive element and not towards the test pattern shall not be included. For example, the exit port of a light guide can be included but the light guide itself shall not be included unless the pipe includes optical properties to direct light towards the test pattern.

4.2.2.4 Reflective element examples include: surfaces manufactured from a reflective metallic material (aluminum, steel, etc.), non-diffusing surfaces coated with a reflective material (vacuum metalize, argent paint, chrome, white paint, or other reflective coating material typical for reflecting light), any molded white plastic or other reflective colored non-scattering surfaces typical for reflecting light, etc.

4.2.2.5 Refractive element examples include: pillow optics, flutes, prisms, fresnel lenses, or similar optical elements intended to redirect light towards the test pattern.

4.2.3 Diffusion Elements

4.2.3.1 Identify all diffusion elements applicable for the lamp function. Diffusion elements which only receive light from rays split off from their primary intended trajectory are not included.

4.2.3.2 Diffusion element examples include: reflective surfaces with scattering structures like stipple, knurling, or similar structures or refractive elements with similar type structures.

NOTE: Lens materials which diffuse light through material properties may not comply with the haze requirements specified in Federal Motor Vehicle Safety Standard 49CFR 571.

4.3 Determination of EPLLA

Calculate or measure the area of each identified element specified in 4.2 when projected onto the plane specified in 4.1. Any element shared with another lamp function shall only be included if the light output of the shared element changes or the color changes when the lamp function being measured is activated. Reference Figure 1.

Sum the area measurements of the applicable elements identified for the lamp function.