SURFACE VEHICLE STANDARD

J593™	OCT2021
Issued 1947-08 Revised 2021-10 Superseding J593 JUL2016	

(R) Backup Lamp (Reversing Lamp)

RATIONALE

The subject of nighttime backup lamp (reversing lamp) contribution to the rear view camera display image was brought up as an item of new business during the September 12, 2018, SAE Signaling and Marking Devices (SMD) Standards Committee meeting. Vehicle manufacturers have become increasingly aware the current SAE J593 backup lamp photometric specification doesn't assure an optimal nighttime rear view camera display image. The majority of the SAE SMD committee members agreed a task force should be formed to study this subject. An SAE J593 Backup Lamp Task Force was established to study possible revisions to SAE J593 to augment the ability of rear view camera systems to provide a reasonable view of the road scene behind a vehicle during reverse mode operation at night.

For background, all United States and Canadian market passenger cars, multipurpose passenger vehicles, trucks, buses, and low-speed vehicles with a gross vehicle weight rating up to 4536 kg (10000 pounds) manufactured on or after May 1, 2018, must be equipped with a rear visibility system that includes a rear-mounted video camera and an in-vehicle visual display. The current photometric pattern of the SAE J593 backup lamps was established long before backup cameras and associated image display screens existed.

The task force reviewed test requirements for the rear visibility system as specified in FMVSS 111 (Rear Visibility) and CMVSS 111 (Mirrors and Rear Visibility Systems). Both FMVSS and CMVSS 111 require the entire height of test objects located 0.3 m, 3.05 m, and 6.1 m behind the vehicle to be visible in the display. Additionally, neither requires compliance in low ambient light (nighttime conditions).

Some vehicle manufacturers have been receiving customer feedback that the image of the ground behind the vehicle at night in the backup camera display screen is less than ideal. The present SAE J593 photometric table's only downward test points are at 5 degrees below the horizon. This does not address the area of the ground immediately behind the vehicle at night which is the same area of the ground used for testing rear view camera images under well lighted conditions.

The task force also reviewed the present regulatory requirements concerning photometry and mounting height above ground for backup lamps installed on vehicles. The backup lamp photometric test points and their minimum candela requirements are presently common in SAE J593, FMVSS 108 and UN Regulation 148. There is no mounting height requirement in FMVSS 108 or CMVSS 108 for backup lamps configured for the U.S. and Canadian markets. UN Regulation 48 specifies backup lamps must be installed on a vehicle with the lowest point of the apparent surface not less than 250 mm above ground and the highest point of the apparent surface not more than 1200 mm above ground. There is wide variation in the mounting height of backup lamps depending on factors such as the type of vehicle and vehicle styling. For example, some vehicles are designed with backup lamps mounted low in the rear bumper/fascia, while other vehicles have backup lamps mounted high in the area below the rear glass of the liftgate.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/J593_202110

The task force then examined the effect of the present backup lamp photometric test points at 5 degrees below H relative to mounting height on the vehicle. It was determined these 5D points for a sedan with backup lamps mounted in the fascia 400 mm above the ground (measured to the center of the lamp) intersect the ground 4.6 meters behind the vehicle. On a sport utility vehicle with backup lamps mounted in the liftgate 1100 mm above the ground (measured to the center of the lamp), these 5D test points intersect the ground 12.6 meters behind the vehicle.

An additional study determined that if test points were to be added to the photometric table at 20 degrees down, this would correlate to 1.1 meters behind the vehicle for backup lamp height of 400 mm above the ground, and 3.0 meters behind the vehicle for the backup lamp height of 1100 mm above the ground. The consensus of the task force was to pursue a new photometry table for backup lamps for use on vehicles required to have a rear view camera system and with higher backup lamp mounting heights. The existing backup lamp photometric table would be retained for optional use by vehicles with lower backup lamp mounting heights and/or vehicles without a rear view camera system.

The task force then needed to determine a height above the road surface value to distinguish between vehicles with low backup lamp mounting heights and vehicles with high backup lamp mounting heights. It was noted the photometric tables for front turn signal, rear turn signal, tail, stop, sidemarker, clearance, and identification lamps each refer to a mounting height of 750 mm above the road surface to the lamp reference axis to distinguish lower versus higher mounting heights in regards to required downward test angles. It was also noted that backup lamps mounted integral to a vehicle's rear bumper/fascia generally have a height lower than 750 mm above the road surface, and backup functions integral to rear combination lamps mounted above the rear bumper/fascia generally have a height higher than 750 mm above the road surface. The consensus of the task force was to use 750 mm above the road surface as the value to distinguish between low and high mounting heights of backup lamps installed on vehicles.

While reviewing drafts of the revised SAE J593 document, the task force realized the proposed revisions could best be accomplished with modifications to the existing Figure 1. New photometric test points were added in the region from 10 degrees down to 20 degrees down, and 10 degrees left to 10 degrees right. This region would also be designated Zone VII. Footnote 7 would be added to allow backup lamps with mounting heights less than 750 mm above the road surface to meet the original downward photometry requirements. Footnote 8 would be added to allow vehicles with a gross vehicle weight rating greater than 4536 kg meet the original downward photometry requirements. This allows the previous backup lamp photometric requirements to be retained for optional use by vehicles with lower backup lamp mounting heights and/or vehicles without a rear view camera system.

The task force also discussed two related items that can contribute to the quality of the rear view camera display at night, the uniformity of light on the road surface from a backup lamp system, and red light from tail and stop lamps being combined with the white light from backup lamps during backing events at night. The task force determined these two items were best left to vehicle manufacturers to address. However, these items were added to the Guidelines section of SAE J593 to raise awareness of the issues.

After review by the task force, it was decided the previous 7.1.1 through 7.3 were either irrelevant to lamp design or were addressed by other SAE recommended practices and should be removed.

Specific changes:

- 2.1.2, 2.1.3, and 2.1.4 added to list federal publications referenced in the Rationale.
- Figure 1 modified with new photometric requirements for certain backup lamp installations. Footnotes renumbered and new footnotes 7 and 8 added.
- Previous 7.1.1 through 7.3 removed.
- 7.1.1 added for awareness of backup lamp uniformity of light on road surface.
- 7.1.2 added for awareness of amount of red light from tail and/or stop lamps relative to white backup lamps during backing events at night.

1. SCOPE

This SAE Standard provides installation requirements, test procedures, design guidelines, and performance requirements for backup/reversing lamps.

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 +1 724-776-4970 (outside USA), www.sae.org.

SAE J575 Test Methods and Equipment for Lighting Devices for Use on Vehicles Less than 2032 mm in Overall Width

SAE J576 Plastic Material or Materials for Use in Optical Parts Such as Lenses and Reflex Reflectors of Motor Vehicle Lighting Devices

SAE J578 Chromaticity Requirements for Ground Vehicle Lamps and Lighting Equipment

SAE J759 Lighting Identification Code

2.1.2 U.S. Government Publications

Copies of these documents are available online at https://quicksearch.dla.mil.

CFR Title 49 Part 571.108 Lamps, Reflective Devices and Associated Equipment (FMVSS 108)

CFR Title 49 Part 571.111 Rear Visibility (FMVSS 111)

2.1.3 Transport Canada Publications

Transport Canada documents are available from Transport Canada, Tower C, Place de Ville, 330 Sparks Street Ottawa, Ontario K1A 0N5, Tel: 1-800-305-2059, www.tc.gc.ca.

Canada Motor Vehicle Safety Standard No. 108 (CMVSS 108) – Lighting System and Reflective Devices

Canada Motor Vehicle Safety Standard No. 111 (CMVSS 111) – Mirrors and Rear Visibility Systems

2.1.4 United Nations Publications

Available from United Nations Economic Commission for Europe, Palais des Nations, CH-1211, Geneva 10, Switzerland, or at http://www.unece.org/trans/main/welcwp29.html.

UN Regulation No. 48 Uniform Provisions Concerning the Approval of Vehicles with Regard to the Installation of Lighting and Light-Signaling Devices

UN Regulation No. 148 Uniform Provisions Concerning the Approval of Light-signaling Devices (Lamps) for Power-Driven Vehicles and Their Trailers

3. DEFINITIONS

3.1 BACKUP LIGHT (REVERSING LIGHT) FUNCTION

A light to the rear of the vehicle providing steady illumination behind the vehicle and to provide a warning signal to pedestrians and other drivers when the vehicle is backing up (reversing) or is about to back up.

3.2 BACKUP LAMP (REVERSING LAMP)

Lamp or lamps providing the backup light (reversing light) function.

3.3 POINT OF VISIBILITY

Any point on the lens surface within an area bounded by the intersection of the lens surface with a 25 mm diameter cylinder, the centerline of which passes through the optical center, which is oriented horizontally and parallel with the longitudinal axis of the vehicle.

4. LIGHTING IDENTIFICATION CODE

Backup lamps meeting the requirements of photometry Figure 1 of this document may be identified by the code “R” in accordance with SAE J759.

5. TESTS

5.1 SAE J575 is a part of this report. The following tests are applicable with modifications as indicated:

5.1.1 Vibration Test

5.1.2 Moisture Test

5.1.3 Dust Test

5.1.4 Corrosion Test

5.1.5 Photometric Test

5.1.5.1 Photometric tests shall be made with the photometer at a distance of at least 3 m from the lamp. The H-V axis shall be taken as the horizontal line through the optical center and parallel with the longitudinal axis of the vehicle.

5.1.6 Warpage Test (on Devices with Plastic Components)

5.2 Color Test

SAE J578 is part of this report.

5.3 Materials Test

SAE J576 is part of this report.

6. REQUIREMENTS

6.1 A device when tested in accordance with the test procedures specified in Section 5 shall meet the requirements as specified in SAE J575 unless otherwise noted.

6.1.1 Vibration

6.1.2 Moisture

6.1.3 Dust

6.1.4 Corrosion

6.1.5 Photometry

6.1.5.1 The lamps of a two-lamp system shall be designed to conform to one of the following photometric requirements:

a. Each lamp of the pair is tested to the photometric requirements of Figure 1 and its footnotes, or

b. When two lamps of the same or symmetrically opposite designs are used, the photometric readings along the vertical axis and the average of the readings for the same angles left or right of the vertical axis for one lamp may be used to determine compliance with the requirements of Figure 1, or

c. When two lamps of differing designs are used, they shall be tested individually, and the photometric values added shall meet twice the zone total candela requirements of Figure 1.

6.1.5.2 When only one backup lamp is used on the vehicle, it shall be designed to conform to twice the photometric requirements of Figure 1 and its footnotes.

6.1.5.3 If a backup lamp has portions of its lens which emit non-white light, the lamp or lamps shall be designed to conform to the photometric requirements of this document with white light as defined by 6.2.