



SURFACE VEHICLE STANDARD

J2121™

JUL2023

Issued 1995-04
Revised 2023-07

Superseding J2121 JUL2009

(R) Requirements for Composite Lighting Assemblies
Used on Construction and Industrial Machinery

RATIONALE

This document has been revised to include provisions for replacing incandescent light sources with LED sources. In addition, specific vibration test criteria have been added.

1. SCOPE

This SAE Standard provides general design performance requirements and related test procedures for composite lighting unit assemblies, other than signaling and marking devices, used on earthmoving and road building and maintenance off-road work machines as defined in SAE J1116.

1.1 Purpose

To provide general guidelines and design parameters for lighting assemblies used on construction and industrial machinery.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, 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 J180	Electrical Charging Systems for Off-Road Work Machines
SAE J994	Alarm - Backup - Electric Laboratory Performance Testing
SAE J1029	Lighting and Marking of Construction, Earthmoving Machinery
SAE J1116	Categories of Off-Road Self-Propelled Work Machines

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2023 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

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
<http://www.sae.org>

SAE WEB ADDRESS:

Full document details: SAE J2121_202307

For more information on this standard, visit
https://www.sae.org/standards/content/J2121_202307

Documents

Document Sharing Hub

SAE J1330 Photometry Laboratory Accuracy Guidelines

SAE J2357 Application Guidelines for Electronically Driven and/or Controlled Exterior Automotive Lighting Equipment

SAE J2895 LED Work Lighting Devices

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B117-90 Standard Test Method of Salt Spray (Fog) Testing

3. DEFINITIONS

3.1 COMPOSITE LIGHTING ASSEMBLY

A lighting device fitted with a replaceable light source and typically comprised of lens, reflector and holding mechanism, and housing.

3.2 DESIGN BEAM PATTERN

The beam distribution which establishes 90% of the light output. It is defined typically by angular degrees horizontal by angular degrees vertical.

3.3 DESIGN VOLTAGE OR TEST VOLTAGE

That voltage assigned by the burner manufacturer to establish the specifications for current and light output.

3.4 TEST FIXTURE

A fixture which simulates the mounting interface of the lighting unit to a machine. It may be used for the icing and pressure water test.

3.5 DESIGN LIFE

The rated quiescent average life of a burner or light source in hours, at rated voltage on a test stand (the B50 stand life).

3.6 APPLICATION VOLTAGE

The voltage, generated and distributed by the machine electrical system, that is applied to the lamp terminals.

3.7 LED

An indivisible discrete light source unit containing a semiconductor in which visible light is non thermally produced when a forward current flows as a result of applied voltage.

4. LIGHT SOURCE REQUIREMENTS

4.1 Interchangeability

The light source shall be replaceable with an equivalent light source and acceptable lamp assembly performance be maintained.

4.1.1 LED Replacement of Incandescent Light Source

If an incandescent light source is replaced by an LED equivalent, additional testing is required, as defined in Section 4 of SAE J2895.

4.2 Life

Acceptable life is often determined by the application requirements. These are primarily shock, vibration, voltage transients, and steady-state voltage. The average bench life of the light source shall be mutually agreed upon between lamp manufacturer and machine manufacture

4.3 Steady-State Voltage

The control of steady-state voltage can be very important in the application of a light assembly (especially tungsten lamps).

For tungsten lamps, the re-rating rules are:

- a. Rerated light power = $(V/V_D)^{3.5}$ x light power at V_D
- b. Rerated life = $(V_D/V)^{12}$ x life at V_D
- c. Rerated current = $(V/V_D)^{0.55}$ x current at V_D

where:

V = application voltage

V_D = design voltage

In order to maximize the life and effectiveness of a lamp, the application voltage should be identical to the design voltage. The application voltage is the result of the following:

- a. Alternator output voltage which is dictated by the requirements to re-charge the battery.
- b. Voltage drops resulting from the various control devices such as switches, circuit breakers, etc., in the lamp circuit.
- c. Voltage drop in the electrical cables and ground return of the lamp circuit.

The application voltage is typically adjusted by selecting the lamp circuit cable to provide the appropriate resistance and voltage drop.

Quiescent life tests shall be performed at the nominal design voltage level within 0.1 V. The voltage shall be measured at the light assembly electrical interface.

4.4 Voltage Transients

As shown in Table 1, voltage transients take on many forms depending on their source. Transients can cause immediate failure or significantly shorten the life of the lamp. The system design shall take into account these transients to eliminate or reduce their effect on the life of the light assemblies.