SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE STANDARD

SAE J1029

REV. SEP96

Issued 1974-03
Revised 1996-09

Superseding J1029 MAR86

Submitted for recognition as an American National Standard

(R) LIGHTING AND MARKING OF CONSTRUCTION, EARTHMOVING MACHINERY

This SAE Standard differs technically from ISO 12509 in Scope and Application.

1. ***Scope—***This SAE Standard establishes minimum requirements for lighting and marking earthmoving construction machinery as defined in SAE J1116, 1.1 Self-Propelled Construction Machines—Earthmoving (excluding excavators).

(Construction machinery is normally operated off-highway, and therefore this SAE document is not intended to be used as a basis for regulations by those having authority over on-highway motor vehicles.)

2. ***References***

2.1 **Applicable Publications—**The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J585—Tail Lamps (Rear Position Lamps) for Use on Motor Vehicles Less than 2032 mm in Width
SAE J586—Stop Lamps for Use on Motor Vehicles Less than 2032 mm in Overall Width
SAE J594—Reflex Reflectors
SAE J943—Slow-Moving Vehicle Identification Emblem
SAE J1116—Categories of Off-Road Self-Propelled Work Machines
SAE J1473—Braking Performance—Rubber-Tired Earthmoving Machines

2.2 **Related Publication—**The following publication is provided for information purposes only and is not a required part of this document.

2.2.1 ISO PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 12509—Earth-moving machinery—Lighting, signaling and marking lights, and reflex-reflector devices

3. ***Requirements***

3.1 **Forward Lighting**

3.1.1 This section applies to the lighting requirements for illuminating the area directly ahead of the machine when operated in its normal direction of travel at its maximum level surface speed.

QUESTIONS REGARDING THIS DOCUMENT: (412) 772-8512 FAX: (412) 776-0243
TO PLACE A DOCUMENT ORDER; (412) 776-4970 FAX: (412) 776-0790
SAE WEB ADDRESS http://www.sae.org

3.1.2 At least two headlamps: two general service lamps or two floodlamps shall be used. They shall be so located as to be visible from the entire length of a line located 15 m in front of, and extending 7 m to either side of the centerline of the machine.

3.1.3 Forward lighting shall provide adequate illumination for a distance that exceeds the machine stopping distance. Adequate forward visibility with various work tool attachments shall be considered when positioning the forward lighting on the machine. Stopping distance from the machine maximum level surface speed shall include the distance traveled during the operator reaction time interval added to the braking distance. The distance traveled during a 1.5 s operator reaction time interval can be computed by Equation 1:

$$\text{Distance (m)} = 0.4167 \times \text{km/h} \qquad \text{(Eq. 1)}$$

Braking distance from machine maximum level surface speed shall be established using the procedure described in SAE J1473. This procedure shall be used as reference in establishing the braking distances for lighting purposes for types of machines not covered in the minimum braking specification.

3.1.4 Candela requirements for stopping from machine maximum level surface speed (as calculated in 3.1.3) for headlamps shall be equal to or greater than the values stated in Table 1. Headlamps shall be aimed so that the portion of highest intensity of the beam intercepts the terrain at that distance ahead of the machine that equals the stopping distance from the maximum machine level surface speed.

TABLE 1—CANDELA REQUIREMENTS FOR STOPPING FROM MACHINE MAXIMUM LEVEL SURFACE SPEED(1)

Stopping Distance from Maximum Machine Rated Speed	Minimum Required Candela cd
Up to 30	2493
Up to 45	5609
Up to 60	9972
Up to 75	15581
Up to 90	22437
Up to 105	30539
Up to 120	39888
Up to 135	50483
Up to 150	62325

1. This table was derived from the formula:
[Stopping Distance (m)]^2 x 2.77 (lux) = Minimum Candela

In general, the effective candela of two lamps will be nearly equal to the sum of the candela of the two lamps if both are carefully aimed to intercept the terrain at the same distance. When four lamps are used with provision for dimming, the low beams are normally aimed for a distance closer to the machine than the high beams. When this scheme is used, only the high beam candela portion should be considered to satisfy the value of Table 1.

3.1.5 When lamp units are used as dedicated high beams (aimed for optimum distance vision) provision for dimming is recommended to restrict glare to acceptable limits.

3.2 Work Area Lighting

3.2.1 The following guidelines should be used by the manufacturer, distributor, and end user to select lamps for proper illumination of the work area and the intended machine work application.

3.2.2 Flood lamps are recommended for general illumination of the work tool area of the machines.

3.2.3 General service lamps are recommended for general illumination of areas a short distance from the machine. Typical usage: Rubber-tired loader and backhoe loader, grader, and tractor front lamp.

3.2.4 On certain machines capable of reversing speeds equal to or greater than forward maximum level surface speeds, rear work area lighting may include lamps that meet the general requirements in 3.1.3, 3.1.4, and 3.1.5.

3.3 Rear Lighting Equipment

3.3.1 This section specifies the types of lighting equipment to be used to identify rubber-tired machines when at their normal job site. Lighting equipment should have performance equal to or greater than that specified by SAE J586 for stop lamps and SAE J585 for tail lamps.

3.3.2 Typical machines would include: Rubber-tired machines including loaders (excluding skid steer loaders from stop lamps), dumpers, graders, tractor-scrapers, excavators, backhoe loaders, and tractors.

a. Two tail lamps
b. Two stop lamps

3.4 Rear and Side Marking

3.4.1 This section specifies the marking of all machines with reflectors when at their normal job site or when parked on the job site not being operated. In this document, reflectors are defined as reflex reflectors (SAE J594) or reflective material that shall be visible at night from all distances within 182 to 30 m, when directly in front of lawful lower beams of headlamps. Reflective material shall meet the durability requirements for such material as specified in SAE J943.

3.4.2 RUBBER-TIRED AND TRACK MACHINES—Two red reflectors shall be mounted on the rear of the machine, as low in height as practical and spaced as far apart from the centerline of the machine as practical.

3.4.3 RUBBER-TIRED MACHINES OVER 6 M LONG—Four yellow reflectors, two on each side of the machine with one mounted as far forward as practical and as low in height as practical and one mounted as far rearward as practical and as low in height as practical.

4. Notes

4.1 Marginal Indicia—The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

PREPARED BY THE SAE OPERATOR PROTECTION TECHNICAL COMMITTEE SC3—
LIGHTING AND MARKING