SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J845 | REV. DEC2007

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Superseding J845 MAY1997

(R) Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles

RATIONALE

Based on the results of demonstrations conducted over the last ten years by the Emergency Warning Lights and Devices Standards Committee and the Signaling and Marking Standards Committee, the following changes have been made to this document.

1. Various editorial changes were made to harmonize the language with that used in other warning lights and devices standards.

2. Multiple flash patterns and cyclic patterns have been added. End users have increasingly been requesting non-repetitive flash patterns to prevent complacency.

3. Light Source definition has been added.

4. Light pulse and flash definitions have been revised.

5. Optical Power has been defined.

6. Multiple flash patterns that are user adjustable must be rated as the lowest performance mode.

7. Flash Rate was added to Section 5, “Tests”.

8. Test Voltage – In conformance with other optical warning device reports, a tolerance has been added to the test voltages, and requirements added for 36 volt systems.

9. Environmental tests for flash rate were revised.

10. Photometric performance has been changed from flash energy to meeting a specified optical power and peak intensity. Advances in laboratory instrumentation have made it practical and cost effective to directly measure the optical power generated by any optical warning device. The direct measurement of peak intensity also is readily done with current technology.

11. The redefinition of the white boundary toward blue was added in anticipation of a change to the SAE J578 specification to harmonize color boundaries with the ECE standard.

12. New markings for selective coverage devices were added to provide a marking distinction between omnidirectional devices and devices with selective coverage.

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1. SCOPE

This document provides design guidelines, test procedure references, and performance requirements for omnidirectional and selective coverage, single color, optical warning devices used on authorized emergency, maintenance and service vehicles. It is intended to apply to, but not limited to, surface land vehicles.

2. REFERENCES

2.1 Applicable Publications

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

2.1.1 SAE Publications

Available from SAE, 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 J575 Test Methods and Equipment for Lighting Devices and Components 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 Color Specification

SAE J759 Lighting Identification Code

SAE J1889 L.E.D. Signal and Marking Lighting Devices

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 SAE Publications

Available from SAE, 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 J595 Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles

SAE J1330 Photometry Laboratory Accuracy Guidelines

SAE J2498 Minimum Performance of the Warning Light System Used on Emergency Vehicles

3. DEFINITIONS

3.1 Omnidirectional Optical Warning Device

A flashing optical warning device that projects light in a horizontal 360 degree arc and vertically from 5 degrees up to 5 degrees down. It will appear to project flashes of light to an observer positioned at a fixed location. The flashes of light may be a repetitive signal or a non-repetitive signal. If a non-repetitive signal is used it shall be a block of repetitive signals that have been characterized. This would include all 360° beacons.

3.2 Selective Coverage Optical Warning Device

A flashing optical warning device that projects light in a defined horizontal arc of more than 40 degrees, but less than 360 degrees and vertically from 5 degrees up to 5 degrees down. It will appear to project flashes of light to an observer positioned at a fixed location within the arc of coverage. The flashes of light may be a repetitive signal or a non-repetitive signal. If a non-repetitive signal is used it shall be a block of repetitive signals that have been characterized. This would include all directional and oscillating warning devices, and omnidirectional devices within a lightbar that have the light beam blocked by internal components.

3.3 Light Source

Any single, independently mounted, light-emitting component in the lighting system. A light source may consist of a single optical element or a fixed array of any number of optical elements whose geometric positioning relative to each other is fixed by the manufacturer of the light source and not intended to be modified. To be considered a single source, the elements must be adjacent and operate simultaneously in all modes, if the mode of the device is vehicle operator adjustable.

3.4 Optical Element

Any discrete light emitter such as, but not limited to, an incandescent filament, HID or individual light emitting diode.

3.5 Primary Optical Warning Devices

Devices or groups of devices that are intended to provide the primary visual optical warning signal as called out in each service class. Unless prohibited by law or regulation, a Class 1 device may be used in place of a Class 2 device and a Class 1 or 2 device may be used in place of a Class 3 device.

3.6 Secondary Optical Warning Devices

Devices or groups of devices of lower performance that can be used to provide supplemental optical warning to that provided by the primary optical warning device or devices.

3.7 Class 1 Optical Warning Devices

Primary optical warning devices for use on authorized emergency vehicles responding to emergency situations. These devices are utilized to capture the attention of motorists and pedestrians and warn of a potentially hazardous activity or situation.

3.8 Class 2 Optical Warning Devices

Primary optical warning devices for use on authorized maintenance or service vehicles to warn of traffic hazards such as a lane blockage or slow moving vehicle.

3.9 Class 3 Optical Warning Devices

Primary optical warning devices for use on vehicles authorized to display an optical warning device for identification only.

3.10 Light Pulse

A single, visually continuous emission of optical energy. High frequency modulation is permitted.

3.11 Flash

A light pulse or a train of light pulses, where a dark interval of at least 160 ms separates the light pulse or the last pulse of the train of light pulses from the next pulse or the first pulse of the next train of light pulses. To be considered a train of light pulses, each pulse in the train must begin within 100 ms after the end of the preceding light pulse. Dark interval luminous intensity shall not exceed 2% of the maximum luminous intensity of a flash.

3.12 Optical Power

The integration of the luminous intensity of the flashing light source for a time of 60 seconds ($\int$Idt). Units are Candela·Seconds/Minute.

4. LIGHTING IDENTIFICATION CODE, MARKINGS, AND NOTICES

4.1 In accordance with SAE J759, the optical warning device may be identified by the codes:

"W3-1", for Class 1 omnidirectional devices.
"W3-2", for Class 2 omnidirectional devices.
"W3-3", for Class 3 omnidirectional devices.
"WS3-1", for Class 1 selective coverage devices.
"WS3-2", for Class 2 selective coverage devices.
"WS3-3", for Class 3 selective coverage devices.

If the optical warning device is a selective coverage device the angle of coverage may also be indicated in parentheses. For example, a Class 1 device providing 120 degrees of signal may be marked WS3-1 (120).

A device may only have one class rating if it is vehicle operator adjustable. The rating shall be based on the mode with the lowest performance level.

5. TESTS

All tests are to be made at 12.8 V dc ± 0.1 V for 12 V systems, 25.6 V dc ± 0.2 V for 24 V systems, and 38.4 V ± 0.3 V for 36 V systems. Tests are to be made using the wiring supplied by the device manufacturer or wire of the minimum size recommended by the device manufacturer. For devices intended to be hard wired into the vehicle electrical system, the voltage shall be measured at 300 mm from the point at which the wiring exits the device. For portable devices equipped with an electrical connector, the voltage shall be measured at the supply side of the connector.

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

5.1.1 Vibration Test

5.1.2 Moisture Test

5.1.3 Dust Test

The change in intensity may be measured at HV.

5.1.4 Corrosion Test

5.1.5 Warpage Test for Plastic Components

The device shall be operated in the mode with the highest optical power.

5.2 Photometry

In addition to the test procedures in SAE J575, the photometric performance shall be determined by measuring the optical power and the peak intensity of each flash. Photometry shall be performed with the light source flashing.

5.2.1 All light sources shall operate until the photometric output is stable prior to testing as defined in SAE J1889.

5.2.2 Photometric measurements shall be made with the device mounted in its normal operating position and all measurements shall be made with the light source of the device at least 18 m from the photometer sensor.

The device shall be mounted so that the horizontal plane through the photometer sensor axis passes through the center of the light source. The vertical axis through the center of the light source shall be perpendicular to this horizontal plane. If the light source is composed of an array of optical elements, the geometric center of the array shall be used.

The H-V reference point for omnidirectional devices shall be determined by turning the device about its vertical axis until the photometer indicates the minimum optical power reading.

The H-V reference point for selective coverage devices shall be the midpoint of its coverage angle or, if it is so marked, as indicated on the device.

5.2.3 An integrating photometer shall be used to determine the optical power projected over 60 seconds. Any measurement period not less than 20 seconds may be used. These measurements shall then be corrected to obtain the optical power in units of cd·sec/min. If the flasher or power supply/flasher has more than one flash pattern, the optical power shall be measured and recorded for each pattern.

5.3 Flash Rate

Any device incorporating an integral flasher, an external flasher, or a combined power supply and flasher supplied by the manufacturer of the device, shall be tested with this flasher.

5.3.1 If a flasher is required and no flasher is supplied by the manufacturer of the device, the device shall be tested using a flasher having a flash rate of 1.20 Hz ± 0.14 Hz with a 50% ± 2% current on time.

5.3.2 The characteristics, including peak intensity, flash rate, period, number of pulses per flash, on time (electrical), off time (electrical) and pulse separation, shall be measured and recorded. If the flasher or power supply/flasher has more than one flash pattern, the characteristics shall be measured and recorded for each pattern.

5.4 Color Test

SAE J578 is a part of this report. The device shall meet the color requirements, with the modifications as indicated, in each mode and at all times. Incandescent devices may be measured while in a steady state mode at design voltage.

The white boundary toward blue shall be x = 0.300.

5.5 Additional Tests

5.5.1 High Temperature Flash Rate Test

The device shall be subjected to an ambient temperature of 50 °C ± 3 °C for a period of 6 hours. The device shall be off (not operating) during the first hour and shall operate continuously for the next 5 hours of the test. The flash rate shall be measured starting 1 minute after the device is activated and at the conclusion of the test. If the device has multiple flash patterns then the pattern with the highest optical power shall be used. The start time shall be measured at time of activation.

5.5.2 Low Temperature Flash Rate Test

The device shall be subjected to an ambient temperature of -30 °C ± 3 °C for a period of 6 hours. The device shall be off (not operating) during the first 5 hours and shall operate continuously for the last hour of the test. The flash rate shall be measured starting 1 minute after the device is activated and at the conclusion of the test. If the device has multiple flash patterns then the pattern with the lowest optical power shall be used. The start time shall be measured at time of activation.

5.5.3 Durability Flash Rate Test

The device shall be operated continuously for 200 hours at an ambient temperature of 25 °C ± 3 °C in cycles consisting of 50 min on and 10 min off. The flash rate shall be measured starting 1 minute after the device is activated and at the conclusion of the test. If the device has multiple flash patterns then the pattern with the highest optical power shall be used.

5.6 Materials Test

SAE J576 is a part of this report.

6. PERFORMANCE REQUIREMENTS

6.1 Performance Requirements

A device, when tested in accordance with the test procedures specified in Section 5, shall meet the following requirements of SAE J575.

6.1.1 Vibration

6.1.2 Moisture

6.1.3 Dust

On completion of the test, the test device shall be considered to have met all the requirements of the dust test when complying with either of the following requirements:

No dust shall be found on the interior surface of the test device, or

The maximum or HV luminous intensity measured after the dust exposure test shall be at least 90% of the initial maximum or HV luminous intensity measured before the test.

6.1.4 Corrosion

6.1.5 Warpage

6.2 Photometry

To be considered compliant, a flash pattern shall meet the optical power requirements contained in Figures 1, 2, or 3 and their footnotes. The summation of the optical power measurements for the specified test points in a zone shall be at least the optical power zone value shown. Additionally, the peak luminous intensity of the pattern shall meet the photometric requirements contained in Figures 1, 2, or 3 and their footnotes. The summation of the peak luminous intensity measurements for the specified test points in a zone shall be at least the peak luminous intensity zone value shown.

In the case of gaseous discharge devices, only compliance to the optical power requirements is required.

For a given flash pattern, compliance to the optical power requirements shall be measured in no greater than 10° increments throughout the coverage angle of the device. For the same flash pattern, compliance to the peak intensity requirements shall be measured at the point of lowest optical power in the horizontal plane within the coverage angle of the device.

6.3 Flash Rate

The flash rate for devices shall be at least 1 Hz and not more than 4 Hz at all times.

6.4 Color

The color of light emitted shall be white, yellow, red, or signal blue as specified in SAE J578.

6.5 Additional Requirements

6.5.1 High Temperature Flash Rate Test

There shall be no evidence of operating conditions that would result in failure to comply with Section 6 of this document. Operation of the device shall begin and continue within 5 s of the beginning of each operating cycle. The measured flash rates shall not vary by more than 20% from the ambient flash rate.

6.5.2 Low Temperature Flash Rate Test

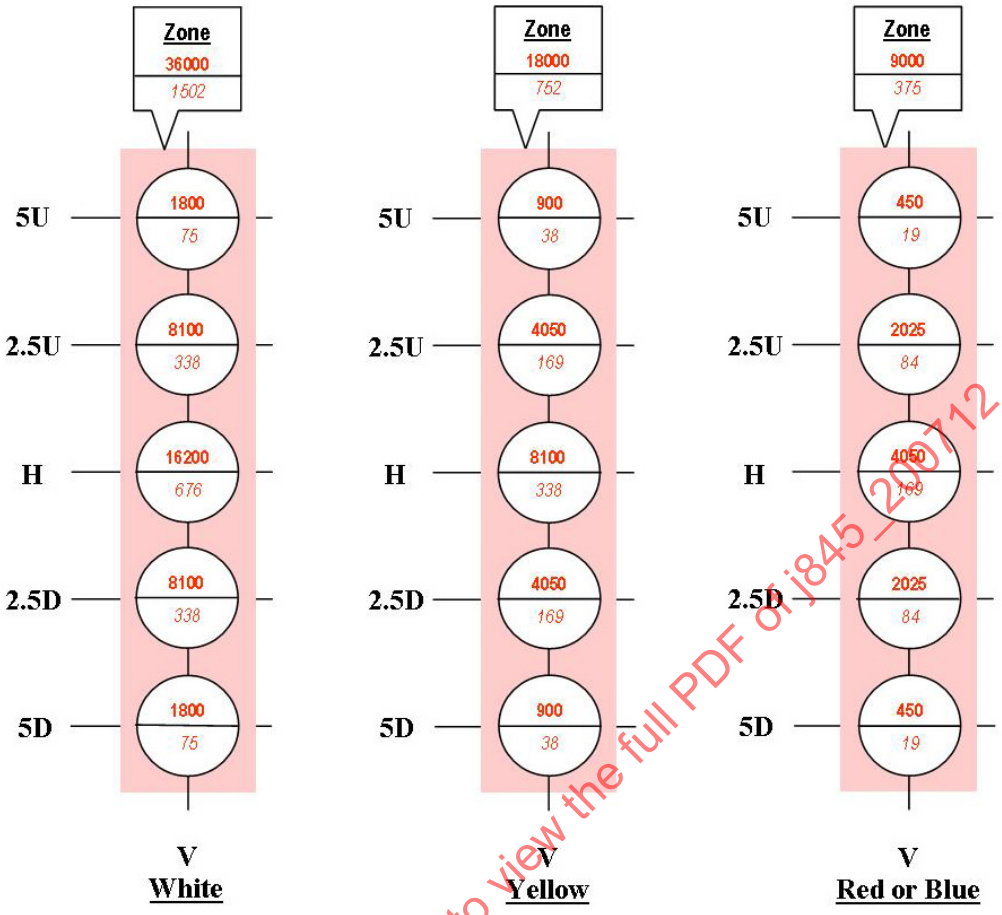
There shall be no evidence of operating conditions that would result in failure to comply with Section 6 of this document. Operation of the device shall begin and continue within 5 s of the beginning of each operating cycle. The measured flash rates shall not vary by more than 20% from the ambient flash rate.

6.5.3 Durability Flash Rate Test

There shall be no evidence of operating conditions that would result in failure to comply with Section 6 of this document. The final measured flash rates shall not vary by more than 20% from the initial flash rates.

6.6 Material Requirements

Plastic materials used in optical parts shall meet the requirements of SAE J576.



1. For each test point and zone total, the value shown in **bold** (top value) is the optical power requirement and the value shown in *italics* (bottom value) is the peak luminous intensity requirement.
2. The measured values at each test point shall not be less than 60% of the required minimum values shown for that individual test point location.
3. The sum of the optical power measurements and the sum of the peak luminous intensity measurements for each test point within a zone, shall not be less than the corresponding zone total requirements shown. The measurements at each discrete test point shown within the corresponding zone are the values used to calculate the specified zone total.
4. An adjustment in device orientation from the design position may be made in determining compliance to the optical power requirements, providing such adjustment does not exceed 1 degree in any direction. All zone totals must comply after reaim.

FIGURE 1 - PHOTOMETRIC REQUIREMENTS - CLASS 1
COLORS: WHITE, YELLOW, RED AND BLUE
Optical Power (Cd-seconds/Minute) Shown in **Bold** (top Value)
Peak Luminous Intensity (Candela) Shown in *Italics* (bottom value)