SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1318

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Superseded by J595 and J845

Gaseous Discharge Warning Lamp for Authorized Emergency, Maintenance, and Service Vehicles

1. ***Scope***—This SAE Recommended Practice provides test procedures, requirements, and guidelines for single-color Gaseous Discharge Warning Lamps.

1.1 Rationale—This document has been superseded by the lighting technology independent documents SAE J595 "Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles" and SAE J845 "Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles" which should now be used for the evaluation of single color gaseous discharge warning lamps in place of SAE J1318.

2. ***References***

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

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

SAE J575—Tests for Motor Vehicle Lighting Devices and Components
SAE J576—Plastic Materials for Use in Optical Parts Such as Lenses and Reflectors of Motor Vehicle Lighting Devices
SAE J578—Color Specification for Electric Signal Lighting Devices
SAE J759—Lighting Identification Code

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of the document.

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

SAE J595—Flashing Warning Lamps for Authorized Emergency, Maintenance, and Service Vehicles
SAE J845—360 Degrees Warning Lamp for Authorized Emergency, Maintenance, and Service Vehicles

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

ISO 4148—Road vehicles—Special warning lights—Dimensions (1978)

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2.2.3 NBS PUBLICATIONS—Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161.

National Bureau of Standards No. 480-3 (June 1977)—Sirens and Emergency Warning Lights
National Bureau of Standards, Special Publication No. 480-16—Emergency Vehicle Warning Lamps, State of the Art
National Bureau of Standards No. 480-36 (July 1979)—Some Psychophysical Tests of the Conspicuities of Emergency Vehicle Warning Lights
National Bureau of Standards No. 480-37 (May 1981)—Emergency Vehicle Warning Systems

3. Definitions

3.1 Light Pulse—A sudden emission of light of short duration and high intensity.

3.2 Light Flash—A single light pulse or a train of pulses. In order for a train of pulses to be considered, a distinct flash the time between adjacent pulses within the train must not exceed 100 ms. If the time separation between adjacent pulses exceeds 100 ms, the pulses must be considered to be parts of two separate flashes. Light pulses with peak luminous intensities less than 10% of the preceding light pulse peak shall be ignored when determining flash type.

3.3 Flash Cycle—A sequence of light flashes and dark intervals which, with regular repetition, constitutes the complete output cycle of a flashing lamp. For a single pulse/single flash lamp, the full cycle consists of a single on-off sequence. For a multiple pulse/single flash lamp, the full cycle consists of two or more light pulses followed by a dark interval that is not less than half the flash cycle. For a multiple flash lamp, the full cycle consists of two or more light flashes followed by a dark interval that is not less than half the flash cycle.

3.4 Gaseous Discharge Warning Lamp—A device that produces a regularly repeating pattern of light flashes when electrical current is discharged periodically through an ionized gas.

3.5 360 Degrees Warning Lamp—A lamp that projects a light in a horizontal 360-degrees arc. It will appear to project a regularly repeating pattern of flashes to an observer positioned at a fixed location. Its function is to inform other highway users to stop, yield right-of-way, or to indicate the existence of a hazardous situation.

3.6 Directional Warning Lamp—A lamp that produces a repetitive flash of light which is directionally aimed and will project a flashing beam signal over a minimum area from 20 degrees right to 20 degrees left on a horizontal plane and from 10 degrees up to 10 degrees down on a vertical plane.

3.7 Primary Warning Lamps—Lamps or groups of lamps that are intended to provide the primary visual 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 in place of a class 3 device.

3.8 Secondary Warning Lamps—Lamps or groups of lamps that can be used to provide a supplemental warning signal for each service class.

3.9 Class 1 Warning Lamps—Primary Warning Lamps for use on authorized emergency vehicles responding to emergency situations. These lamps are utilized to capture the attention of motorists and pedestrians and to warn of a potentially hazardous activity or situation. The photometric performance of these lamps is specified in Tables 1 and 2 or Tables 3 and 4.

3.10 Class 2 Warning Lamps—Primary Warning Lamps for use on authorized maintenance and service vehicles to warn of traffic hazards such as an accident, slow-moving service truck, etc. The photometric performance of these lamps is specified in Tables 5 and 6.

3.11 Class 3 Warning Lamps—Primary Warning Lamps for use on vehicles that are authorized to display flashing warning lamps for identification only. The photometric performance of these lamps is specified in Tables 7 and 8.

3.12 Flash Energy—Flash Energy is the total luminous energy per unit solid angle contained in the entire flash in candela seconds.

$$\text{candela second} = \int_{t_1}^{t_2} I\,dt \qquad \text{(Eq. 1)}$$

where:

I = Instantaneous intensity (candela)
t_1 = Time at start of flash (seconds)
t_2 = Time at end of flash (seconds)

3.13 Light Center—The light center of a gaseous discharge warning lamp is the geometric center of the light emitting element (arc or light source) of the lamp.

4. Lighting Identification Code

4.1 Gaseous discharge warning lamps may be identified in accordance with SAE J759, by the codes:

360-degrees gaseous discharge lamps

(W5-1) - Class 1
(W5-2) - Class 2
(W5-3) - Class 3

Directional gaseous discharge lamps

(W5) -

5. Tests—In all instances where a device is required to be operated during a test specified in this report, the voltage applied to the input wires or terminals of the device shall be 12.8 V for nominal 12 V electrical systems and 25.6 V for nominal 24 V electrical systems. Devices designed for voltages other than 12 VDC and 24 VDC shall be tested at their design voltage.

5.1 SAE J575—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 PHOTOMETRY—In addition to the photometric test procedures in SAE J575, the following apply:

5.1.5.1 The device shall be allowed to operate for 15 minutes prior to making photometric measurements.

5.1.5.2 *Photometric Measurement for 360-Degrees Gaseous Discharge Warning Lamps*—Photometric measurements shall be made with the device mounted in its normal operating position and all flash energy measurements shall be made with the light source of the signal lamp at least 18 m from the photometer sensor. The lamps shall be mounted so that the horizontal plane through the photometer 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. The lamp shall be turned about its vertical axis until the photometer indicates minimum flash energy. This shall be the H-V point.

5.1.5.3 *Photometric Measurement for Directional Gaseous Discharge Warning Lamps*—Photometric measurements shall be made with the device mounted in its normal operating position and all flash energy measurements shall be made with the light source of the warning lamp at least 18 m from the photometer sensor. The lamps 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.

5.1.5.4 Photometric luminous intensity measurements (candela seconds) shall be taken as the average of at least ten consecutive flash cycles. Multiple flash systems shall only have their primary, usually the first, light flash recorded. Energy from secondary light flashes shall not be included in the luminous intensity measurements.

5.1.6 WARPAGE TEST ON DEVICE WITH PLASTIC COMPONENTS—The test procedure described in SAE J575, shall be modified with the following operating cycle:

5.1.6.1 *Flash Tube Operation*—Unless otherwise specified, the gaseous discharge device shall be operated in a steady flash mode.

5.2 Color Test—SAE J578 is a part of this report. Devices shall be tested with the light source normally supplied with the lamp. When it is not feasible to make measurements with this light source, a steady burning CIE Illuminant C (6774 K) light source shall be substituted.

5.3 Plastic Materials—Plastic materials used in optical components shall be tested in accordance to SAE J576, unless otherwise indicated.

5.4 Additional Tests

5.4.1 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 during the first hour and shall operate continuously for the next 5 h.ours The flash rate shall be measured before the test, not less than 3 minutes nor more than 4 minutes after the beginning of the second hour of the test, and not less than 3 minutes nor more than 4 minutes after the end of the test.

5.4.2 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 during the first 5 hours and shall operate continuously for the last hour of the test. The flash rate shall be measured before the test, not less than 3 mintues nor more than 4 minutes after the beginning of the last hour of the test, and not less than 3 mintues nor more than 4 minutes after the end of the test.

5.4.3 DURABILITY TEST—The device shall be operated continuously for 200 hours at an ambient temperature of 25 °C ± 3 °C in cycles of 50 minutes on and 10 minutes off. The flash rate shall be measured before the test and not more than 3 minutes after the last off period at the end of the test.

6. Requirements

6.1 Performance Requirements—A device when tested in accordance with the test procedures specified in Section 5 shall meet the following requirements in SAE J575:

6.1.1 VIBRATION

6.1.2 MOISTURE

6.1.3 DUST

6.1.4 CORROSION

6.1.5 PHOTOMETRY—The lamp under test shall meet the photometric performance requirements contained in Tables 1, 3, 5, or 7. The summation of the flash energy measurements at the specified test points in a zone shall be at least the value shown.

6.1.6 WARPAGE—Shall meet the requirements of SAE J575.

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

6.3 Material Requirements—Plastic materials used in optical parts shall meet the requirements of SAE J576.

6.4 Additional Requirements

6.4.1 HIGH-TEMPERATURE FLASH RATE—There shall be no evidence of operating conditions which would result in failure to comply with Section 6. The measured flash rates shall be between 1 to 4 Hz and within 20% of the value measured at the start of the test.

6.4.2 LOW-TEMPERATURE FLASH RATE—There shall be no evidence of operating conditions which would result in failure to comply with Section 6. The lamp must flash and continue to flash within 20 seconds after the voltage is applied or it is considered a failure. The measured flash rates shall be between 1 to 4 Hz and within 20% of the value measured at the start of the test.

6.4.3 DURABILITY—There shall be no evidence of operating conditions which would result in failure to comply with Section 6. The measured flash rates shall be between 1 to 4 Hz and within 20% of the value measured at the start of the test.

7. Guidelines

7.1 Photometric Guidelines—Photometric design guidelines for 360 degrees and directional gaseous discharge warning lamps, when tested in accordance with 5.1.5 of this document, are contained in Tables 2, 4, 6, and 8. If a green warning lamp is requested it should meet the photometric requirements of blue and comply with SAE J578.

7.2 Installation Guidelines—The following guidelines apply to 360 degrees and directional gaseous discharge warning lamps as used on the vehicle and shall not be considered part of the requirements:

7.2.1 MOUNTING—The vertical axis of the lamp should be installed normal to the longitudinal axis of the vehicle.

7.2.2 VISIBILITY—Visibility of the 360-degrees warning lamp should be unobstructed by any part of the vehicle 5 degrees above to 5 degrees below the horizontal and provide a flashing light throughout a 360-degrees circle. Additional primary warning lamps may be used whenever vehicle size or design prevents a single primary warning lamp from projecting 360 degrees of a full-strength warning signal. These additional warning lamps shall be mounted so that the 360 degrees of full-strength signal is obtained around the vehicle.

Directional warning lamps should be mounted as high as practical and if mounted in pairs, as far apart as practical. Visibility to the front and to the rear of the vehicle should be unobstructed by any part of the vehicle from 10 degrees up to 10 degrees below horizontal and from 45 degrees left to 45 degrees right of the centerline of the vehicle. To improve the effectiveness of the signal it is recommended that when practical, the area surrounding the lamps should be black.

7.2.3 INDICATOR—There should be a visible or audible means of giving a clear and unmistakable indication to the driver when the warning lamps are turned on and functioning.

7.3 Test Equipment Guidelines—The following guidelines apply to photometric test equipment and are not part of the technical requirements:

7.3.1 A pulse integrating photometer or other accepted means of measuring pulsed light signals shall have the following characteristics:

a. Response Time—1 μs or less
b. Sensor Response—The sensor response shall be corrected to that of the 1931 C.I.E. standard observer (2 degrees) photopic response curve. The sensor shall be calibrated for the color range of the light being measured.
c. Range Linearity—The linearity of the sensor and photometer system shall be verified over the range of the luminous intensities being tested. Linearity deviation shall not be more than 2.5% from the calibration level to the extreme luminous intensity values measured.

7.3.2 The regulated D.C. power supply shall have the following minimum requirements:

Line regulation—±0.1%
Load regulation—±0.1%
Ripple voltage—±0.4%
Stability—±0.1% during test

TABLE 1—PHOTOMETRIC REQUIREMENTS CLASS 1
360 DEGREES GASEOUS DISCHARGE WARNING LAMPS
Minimum Flash Energy Requirements
Zone Totals (Candela Seconds)

Zone	Test Point Degree	Flash Energy—Candela Seconds White	Flash Energy—Candela Seconds Yellow	Flash Energy—Candela Seconds Red	Flash Energy—Candela Seconds Signal Blue
1	5U-V 2.5U-V H-V 2.5D-V 5D-V	400	200	100	100

NOTES:
a. A one time adjustment in lamp orientation from design position may be made in determining compliance to Table 1 provided such adjustment does not exceed 1 degree in any direction. The zone shall comply after this one time, final reaim.
b. When calculating zone totals, the measured value at each test point shall not be less than 60% of the minimum values in Table 2.

TABLE 2—PHOTOMETRIC DESIGN GUIDELINES
360 DEGREES GASEOUS DISCHARGE WARNING LAMPS
Minimum Design Flash Energy Guidelines Class 1 Warning Lamps

Test Point Degree	Flash Energy–Candela Seconds White	Flash Energy–Candela Seconds Yellow	Flash Energy–Candela Seconds Red	Flash Energy—Candela Seconds Signal Blue
5U–V	20	10	5.0	5.0
2.5U–V	90	45	22.5	22.5
H–V	180	90	45.0	45.0
2.5D–V	90	45	22.5	22.5
5D–V	20	10	5.0	5.0

TABLE 3—PHOTOMETRIC REQUIREMENTS CLASS 1
DIRECTIONAL, GASEOUS DISCHARGE WARNING LAMPS
Minimum Flash Energy Requirements Zone Totals (Candela Seconds)

Zone	Test Point Degree	Flash Energy–Candela Seconds White	Flash Energy–Candela Seconds Yellow	Flash Energy–Candela Seconds Red	Flash Energy—Candela Seconds Signal Blue
1	5U–10L 5U–20L H–20L 5D–20L 5D–10L	108	54	27	27
2	10U–5L 10U–V 10U–5R	56	28	14	14
3	5U–5L H–10L 5D–5L	184	92	46	46
4	5U–V H–5L H–V H–5R 5D–V	664	332	166	166
5	5U–5R H–10R 5D–5R	184	92	46	46
6	10D–5L 10D–V 10D–5R	56	28	14	14
7	5U–10R 5U–20R H–20R 5D–20R 5D–10R	108	54	27	27

NOTES:

a. A one time adjustment in lamp orientation from design position may be made in determining compliance to Table 3 provided such adjustment does not exceed 1 degree in any direction. The zone shall comply after this one time, final reaim.

b. When calculating zone totals, the measured value at each test point shall not be less than 60% of the minimum values in Table 4.

TABLE 4—PHOTOMETRIC DESIGN GUIDELINES
DIRECTIONAL, GASEOUS DISCHARGE WARNING LAMPS
Minimum Flash Energy Guidelines
Class 1 Warning Lamps

Test Point Degree	Flash Energy—Candela Seconds White	Flash Energy—Candela Seconds Yellow	Flash Energy—Candela Seconds Red	Flash Energy—Candela Seconds Signal Blue
10U–5L	12	6	3	3
10U–V	32	16	8	8
10U–5R	12	6	3	3
5U–20L	12	6	3	3
5U–10L	32	16	8	8
5U–5L	68	34	17	17
5U–V	100	50	25	25
5U–5R	68	34	17	17
5U–10R	32	16	8	8
5U–20R	12	6	3	3
H–20L	20	10	5	5
H–10L	48	24	12	12
H–5L	132	66	33	33
H–V	200	100	50	50
H–5R	132	66	33	33
H–10R	48	24	12	12
H–20R	20	10	5	5
5D–20L	12	6	3	3
5D–10L	32	16	8	8
5D–5L	68	34	17	17
5D–V	100	50	25	25
5D–5R	68	34	17	17
5D–10R	32	16	8	8
5D–20R	12	6	3	3
10D–5L	12	6	3	3
10D–V	32	16	8	8
10D–5R	12	6	3	3