



SURFACE VEHICLE STANDARD

J578™

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Superseding J578 MAR2016

Color Specification

RATIONALE

There are instances where two distinct lighting functions with different individual colors, when operated simultaneously, may cause confusion in a traffic environment by producing a color of light different than that of either function operated alone. This SAE J578 update provides guidance for device testers and lighting manufacturers on awareness and managing this effect, which can occur during simultaneous operation of multiple lighting functions that are optically combined or separate, but in close proximity. The optically combined situation is addressed in this document, but the close proximity situation is not because present color measurement and optical simulation approaches cannot reliably predict and measure it.

The precautions in A.1 were modified and moved to Section 4, because they pertain to color variations likely to occur in optically combined lamps providing multiple lighting functions of differing colors.

The title of SAE J774, "Emergency Warning Device and Emergency Warning Device Protective Container," was updated.

The publication number of CFR Title 49 Part 571.125, "Warning Devices, 39 FR 28636, Aug. 9, 1974 as amended at 40 FR 4, Jan. 2, 1975," was updated.

The publication number of CFR Title 49 Part 571.108, "Lamps, Reflective Devices and Associated Equipment (FMVSS 108)," was updated.

A.6, which listed ASTM E308 as a cited publication, was removed, since this document is already referenced in 2.1.3.

1. SCOPE

This SAE Standard defines and provides a means for the control of colors employed in motor vehicle external lighting equipment, including lamps and reflex reflectors. The document applies to the overall effective color of light emitted by the device in any given direction, and not to the color of the light from a small area of the lens. It does not apply to pilot, indicator, or tell-tale lights.

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VWGoA EX1069
VWGoA v. Spero
IPR2023-00335

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 J774 Emergency Warning Device and Emergency Warning Device Protective Container

2.1.2 Code of Federal Regulations (CFR)

Available from the United States Government Printing Office, 732 North Capitol Street, NW, Washington, DC 20401, Tel: 202-512-1800, www.gpo.gov.

CFR Title 49 Part 571.125 Warning Devices, 39 FR 28636, Aug. 9, 1974 as amended at 40 FR 4, Jan. 2, 1975

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

2.1.3 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 E308 Standard Practice for Computing the Colors of Objects by Using the CIE System

2.1.4 CIE Publications

Available from CIE Central Bureau, Babenbergerstrasse 9/9A, 1010 Vienna, Austria, Tel: +43 1 714 31 87, www.cie.co.at.

CIE 1931 Standard - Colorimetry

2.2 Related Documents

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

2.2.1 IES Publications

Available from Illuminating Engineering Society, 120 Wall Street, Floor 17, New York, NY 10005-4001, Tel: 212-248-5000, www.ies.org.

IES TM-27-24 IES Standard Format for the Electronic Transfer of Spectral Data.

3. DEFINITIONS

3.1 CHROMATICITY COORDINATES

The fundamental requirements for color are expressed as chromaticity coordinates according to the CIE (1931) standard colorimetric system (see Figure 1). The following requirements shall apply when measured by the tristimulus or spectrophotometric methods.

3.1.1 Red

The color of light emitted from the device shall fall within the following boundaries:

Boundary Equations	Boundary Vertex Points	
	x	y
$y = 0.335$ (yellow boundary)	0.665	0.335
$y = 0.980 - x$ (purple boundary)	0.645	0.335
	0.721	0.259
	0.735	0.265

3.1.2 Yellow (Amber)

The color of light emitted from the device shall fall within the following boundaries:

Boundary Equations	Boundary Vertex Points	
	x	y
$y = x - 0.120$ (green boundary)	0.560	0.440
$y = 0.390$ (red boundary)	0.545	0.425
$y = 0.790 - 0.670x$ (white boundary)	0.597	0.390
	0.610	0.390

3.1.2.1 Selective Yellow (See A.1)

The color of light emitted from the device shall fall within the following boundaries:

Boundary Equations	Boundary Vertex Points	
	x	y
$y = 1.290x - 0.100$ (green boundary)	0.480	0.519
$y = 0.138 + 0.580x$ (red boundary)	0.454	0.486
$y = 0.440$ (white boundary)	0.500	0.440
$y = 0.940 - x$ (white boundary)	0.521	0.440
	0.545	0.454

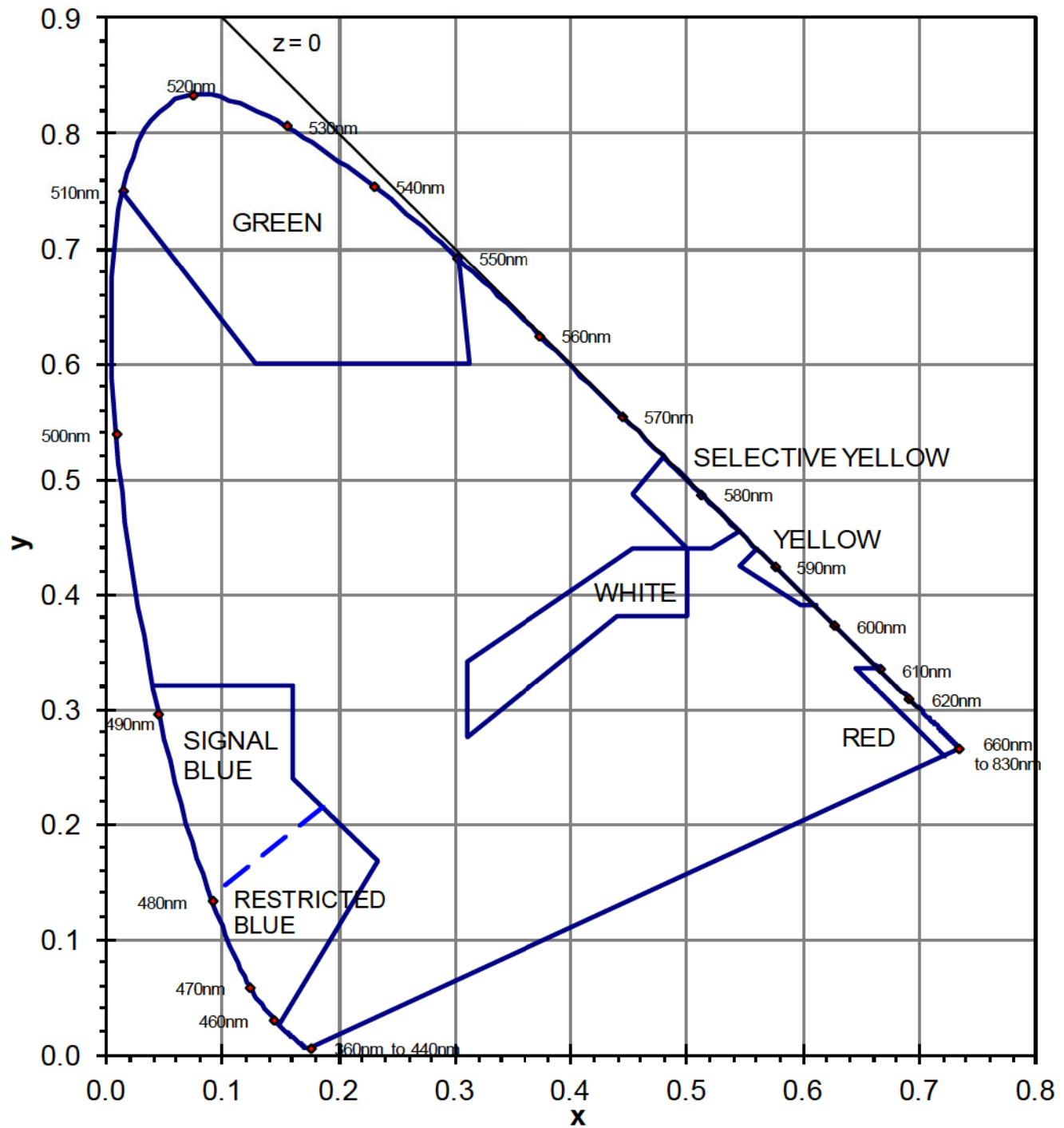


Figure 1 - Chromaticity diagram

3.1.3 White (Achromatic)

The color of light emitted from the device shall fall within the following boundaries:

Boundary Equations	Boundary Vertex Points	
	x	y
$x = 0.310$ (blue boundary)	0.310	0.342
$x = 0.500$ (yellow boundary)	0.310	0.275
$y = 0.150 + 0.640x$ (green boundary)	0.440	0.382
$y = 0.050 + 0.750x$ (purple boundary)	0.500	0.382
$y = 0.440$ (green boundary)	0.500	0.440
$y = 0.382$ (red boundary)	0.453	0.440

3.1.4 Green

The color of light emitted from the device shall fall within the following boundaries:

Boundary Equations	Boundary Vertex Points	
	x	y
$y = 3.470 - 9.200x$ (yellow boundary)	0.014	0.750
$y = 0.600$ (white boundary)	0.129	0.600
$y = 0.768 - 1.306x$ (blue boundary)	0.312	0.600
	0.302	0.692

3.1.5 Blue

3.1.5.1 Restricted Blue (See A.1)

The color of light emitted from the device shall fall within the following boundaries:

Boundary Equations	Boundary Vertex Points	
	x	y
$y = 0.065 + 0.805x$ (green boundary)	0.090	0.137
$x = 0.400 - y$ (white boundary)	0.186	0.215
$x = 0.133 + 0.600y$ (violet boundary)	0.233	0.167
	0.148	0.026

3.1.5.2 Signal Blue (See A.1)

The color of light emitted from the device shall fall within the following boundaries:

Boundary Equations	Boundary Vertex Points	
	x	y
$y = 0.320$ (green boundary)	0.040	0.320
$x = 0.160$ (white boundary)	0.160	0.320
$x = 0.400 - y$ (white boundary)	0.160	0.240
$x = 0.133 + 0.600y$ (violet boundary)	0.233	0.167
	0.148	0.026

4. TEST METHODS

4.1 Method of Color Measurement

One of the methods listed in 4.1.1 or 4.1.2 shall be used to check the color of the light from the device, or its optical components, for compliance with the color specifications. The device shall be operated at the design test voltage. Components (bulbs, cap lenses, and the like) shall be tested in a fixture or in a manner simulating the intended application.

In measuring the color of reflex devices, precautions shall be made to eliminate the first surface reflections of the incident light.

Lighting devices that are covered with neutral density filters shall be tested for color with such filters in place.

If two or more lighting functions are optically combined, the color requirement of each function shall be met when individually illuminated. In addition, if the functions are illuminated simultaneously, the emitted light shall not be a color other than the colors permitted by the requirements of the illuminated functions.

Some devices may emit a different color of light in one direction than another. Measurements shall be made in as many directions as needed to define the color characteristics of emitted light and to ensure the color requirement of the function is met in all directions.

Some instruments (tristimulus and spectroradiometric) use an integrating sphere at the inlet port of the device to integrate all the light from the device. Care shall be taken to assure that the integrating sphere is not combining different color light emitted in different directions from the device and thereby providing an erroneous reading.

The lamp and optical components shall be allowed to reach operating temperature before any measurements are made.

If the device does not visually appear to be emitting light with a uniform color, additional measurements shall be taken to ensure the color requirement of the function is met in all directions.

The distance between the test instrument and the device under test should be great enough so that further increases in distance do not affect the results.

4.1.1 Tristimulus Method

In this method, photoelectric detectors with spectral responses that approximate the 1931 CIE standard spectral tristimulus values are used to make the color measurements. These measured tristimulus values are used to calculate the chromaticity coordinates of the color of emitted light from the device. The instrument used for this type of measurement is a colorimeter. These instruments are generally used for production control of color and are satisfactory if calibrated against color filters of known chromaticity coordinates. As a rule, the tristimulus method should only be used on incandescent steady-state sources. Other sources must use the method prescribed in 4.1.2.

Visual tristimulus colorimeters can also be used for color evaluation.

4.1.2 Spectrophotometric Method

The standard CIE method of color measurement is computing chromaticity coordinates from the spectral energy distribution of the device. This method should be used as a referee approach when the commonly used methods produce questionable results.

Refer to ASTM E308 for more details on spectrophotometric measurements.

5. NOTES

5.1 Revision Indicator

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

PREPARED BY THE SAE LIGHTING STANDARD PRACTICES COMMITTEE

APPENDIX A

A.1 COLOR APPLICATION

Selective yellow is used on a limited basis primarily for fog lights and is not to be used in turn signal, parking, identification, clearance, sidemarker, and school bus warning lamps, or yellow reflex reflector applications as required by FMVSS 108.

Restricted blue is used when the reliable identification of the signal light as blue is necessary.

Signal blue is used when the reliable identification of the signal light as blue is not necessary.

A.2 NEUTRAL DENSITY

Filtering materials are sometimes used over existing lighting devices to reduce the light intensity, but not to change the fundamental color requirements as detailed in this document.

A.3 ORANGE FLUORESCENT INFORMATION GUIDELINE

Definitions and requirements for orange fluorescent color can be found in the appropriate SAE Recommended Practice or Standard. Refer to SAE J774, or FMVSS No. 125, Warning Devices, 39 FR 28636, Aug. 9, 1974 as amended at 40 FR 4, Jan. 2, 1975.

A.4 COLOR MEASUREMENTS OF GASEOUS DISCHARGE LIGHTING DEVICES

Some laboratories cannot measure the color of light from the short pulses of lamps that use discharge tubes; therefore, these lamps need a steady burning test source, operated at the color temperature of the gaseous discharge warning lamp. Use of CIE Illuminant C for strobe lights has been confirmed by independent testing laboratories.