



CIE S 004/E-2001

Standard

Colours of Light Signals

Couleurs des signaux lumineux

Farben von Signallichtern

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S 004/E

UDC: 535.625
628.975
656.54

Descriptor: Coloured light signals
Signal lighting
Traffic signals

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FOREWORD

Standards produced by the Commission Internationale de l'Éclairage (CIE) are a concise documentation of data defining aspects of light and lighting, for which international harmony requires such unique definition. CIE Standards are therefore a primary source of internationally accepted and agreed data, which can be taken, essentially unaltered, into universal standard systems.

The CIE undertook a major review of its official recommendations for the colours of light signals in the period 1987 to 1993 and developed this Standard based on that review.

This Standard has been approved by the National Committees of the CIE and supersedes the recommendations made in CIE Publication 2.2 - 1975 *Colours of Light Signals*.

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COLOURS OF LIGHT SIGNALS

INTRODUCTION

National and international standards for visual signal systems usually specify requirements for the colours of light signals to ensure that the colours can be correctly identified. The previous official recommendations of the CIE provided sound guidance on the choice of these colours and were utilised in the drafting of most relevant standards.

The CIE first adopted recommendations for light signal colours in 1959. These were based on three experiments carried out in the 1930s and 1940s and on the technical and practical knowledge of the experts serving on the CIE committees that prepared the recommendations. Account was also taken of current practices and standards as well as the practical limitations of coloured signal glasses and signal assemblies and the need to generate signals of sufficient intensity.

Following new experimental work as well as experience in the application of the 1959 recommendations, a revision of the recommendations was published by the CIE in 1975 as CIE Publication 2.2 - 1975 *Colours of Light Signals*.

In 1987 the CIE saw the need for another revision based on further experimental work and changing needs and technology in visual signalling. Committee TC4-14 (Colours of Signal Lights) of CIE Division 4 (Lighting and Signalling for Transport) undertook a detailed analysis of the experiments on the recognition of light signal colours and consulted widely among the international experts on visual signalling.

The Committee reported its findings in CIE Technical Report 107 *A Review of the Official Recommendations of the CIE for the Colours of Signal Lights*, which was published by the CIE in 1994. This Technical Report contains details of relevant experiments, arguments regarding colour discrimination, recommendations and an extensive bibliography.

The recommendations of the committee were adopted by Division 4 of the CIE in 1992 and have guided the preparation of this International Standard.

1. SCOPE

This Standard specifies the allowable colours for steady signal lights and flashing signal lights where the duration of the on period is at least one second.

It is applicable to the colours of signal lights used in sea, road, air and rail transport systems including signal lights on ships, aircraft, motor vehicles and trains, where the recognition of the colours involved is essential.

The Standard can also be used for guidance on the selection of the colours

- of light signals and warning lights on instrument panels in vehicles,
- of light signals and warning lights on instrument panels used for monitoring or control of industrial processes,
- used in visual display terminals when recognition of the colour code is important to interpreting the information displayed.

The Standard does not specify how signal lights should be used in the various transport modes nor does it specify the meanings to be associated with the different colours. Reference must also be made to international, regional and national conventions and regulations for sea, rail, road and air transport¹ which specify how the colours should be used for particular applications.

¹ For motor vehicle lighting also refer to the applicable regulations annexed to the United Nations agreement, Geneva 1958 and later revisions, concerning the adoption of uniform technical prescriptions for wheeled vehicles; equipment and parts which can be fitted and/or used on wheeled vehicles and the conditions for reciprocal recognition of approvals granted on the basis of these prescriptions. For airport and aircraft signal lights consult also the pertinent International Civil Aviation Org. requirements.

This Standard is not applicable to the colours of surface colour codes. Guidance on the allowable colours for surface colour codes is given in CIE Publication 39.2-1983 *Recommendations for Surface Colours for Visual Signalling*.

2. NORMATIVE REFERENCES

The following standards contain provisions that, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying most recent editions of the standards indicated below. Members of CIE, the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO) maintain registers of currently valid international standards.

CIE 15.2-1986: *Colorimetry*

CIE 17.4-1987: *International Lighting Vocabulary (ILV)* - equivalent to IEC 50(845)

ISO/CIE 10527-1991: *CIE standard colorimetric observers*

3. DEFINITIONS

For the purpose of this Standard, the following definitions apply:

3.1 CIE 1931 standard colorimetric system (X Y Z) (see ILV 845-03-28)

A system for specifying colour by determining the tristimulus values of the spectral power distribution of a coloured light using the set of reference colour stimuli [X], [Y], [Z] and the three CIE colour matching functions $\bar{x}(\lambda), \bar{y}(\lambda), \bar{z}(\lambda)$, adopted by the CIE in 1931 (see CIE 15.2-1986), such that:

$$X = k \int S_{e\lambda} \bar{x}(\lambda) d\lambda \quad Y = k \int S_{e\lambda} \bar{y}(\lambda) d\lambda \quad Z = k \int S_{e\lambda} \bar{z}(\lambda) d\lambda$$

where:

$S_{e\lambda}$	the spectral power distribution of a coloured light,
X, Y, Z	the tristimulus values,
$\bar{x}(\lambda), \bar{y}(\lambda), \bar{z}(\lambda)$	the three CIE colour matching functions adopted by the CIE in 1931,
k	a normalizing constant. For self-luminous objects its value is equal to K_m , the maximum spectral luminous efficacy: 683 lm/W.
λ	the wavelength

3.2 Chromaticity coordinates (see ILV 845-03-33)

Ratio of each of a set of three tristimulus values to their sum. In the CIE 1931 standard colorimetric system:

$$x = \frac{X}{X + Y + Z} \quad y = \frac{Y}{X + Y + Z} \quad z = \frac{Z}{X + Y + Z}$$

where

x, y the chromaticity coordinates of a colour which may be plotted on the 1931 CIE x, y chromaticity diagram to graphically represent the chromaticity in question ($x + y + z = 1, 0$, thus z is redundant given x and y).